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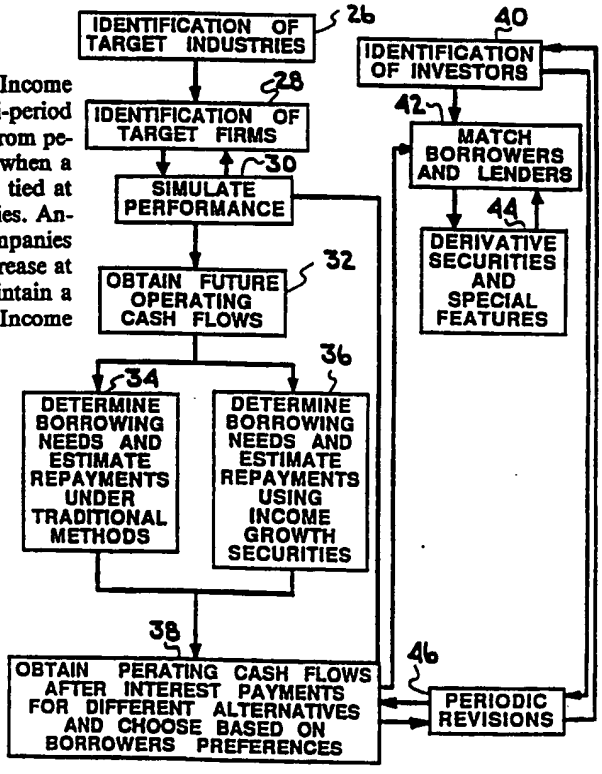
(54) Title: METHODS AND SYSTEMS FOR FINANCING AND INVESTING USING INCOME GROWTH SECURITIES

(57) Abstract

Methods and systems for financing and investing using Income Growth Securities, which are financial instruments having a multi-period repayment schedule, in which the repayement amount increases from period to period by realized inflation. An analysis (26-38) shows when a firm or other entity, having a measure of performance, which is tied at least in part to inflation, ought to issue Income Growth Securities. Another analysis (40-44) shows when pension plans, insurance companies and retirement plans, having liabilities which are expected to increase at least in part with inflation, and endowments, which seek to maintain a constant level of disbursements in real terms, ought to invest in Income Growth Securities.



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METHODS AND SYSTEMS FOR FINANCING AND INVESTING USING INCOME GROWTH SECURITIES

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to systems and methods for financing and investing, and more particularly, to systems and methods for firms and other entities to improve the manner in which they finance their borrowing needs, in particular by better matching the repayment on the borrowing with the earnings ability of the asset being financed, and for investors to better manage their assets, in particular in terms of the ability of the assets to fund future liabilities which are expected to grow at least in part with cumulative realized inflation. The different needs of both issuers and investors are satisfied by issuance of and investment in a new class of securities, Income Growth Securities, whose repayments of principal and interest increase with cumulative realized inflation over time.

Description of the Prior Art

Inflation has always been a problem for borrowers and investors alike. Investors, in order to manage their assets, make an estimate of future inflation and attempt to allocate these assets accordingly. For example, pension plan managers have an obligation to provide retired workers with life annuities. Thus, there is a need to have sufficient funds available at some known future date to meet these commitments. As interest rates fluctuate, the value of the assets held by the plan and its liabilities in general will not change in similar ways. In order to compensate for this difficulty,

inappropriate to th ne ds of the af rementi ned classes f investors described in this invention and Franklin Savings was not a natural issuer in the sense of having assets or other inflation linked sources of cash flow which would naturally match the repayment obligations of these securities.

The idea of a security linked to actual inflation has been in circulation for at least 50 years. In December, 1941, in the American Economic Review an article by Bach and Musgrove discussed a stable purchasing power government bond where " . . . the bond would be redeemable at maturity for that number of dollars which would provide the same purchasing power as the issue price of the bond at the issue date . . . whether interest payments should also be put in terms of stable purchasing power is a secondary and separate question." But nowhere in the analysis do the authors detail the need or rationale for a firm or other entity to issue such bonds.

Beginning in 1981, the British government issued inflation-indexed coupon bonds that paid a coupon in each period which was made up of a real rate of interest and a lagged inflation rate. The principal was also indexed to inflation. In addition to the U.K. government, British Building Societies, which raise funds to lend for mortgages, have also issued index-linked bonds. However, the structure of these bonds require that all the principal is to be repaid at maturity.

In 1977, Professor Stanley Fischer, a leading American financial economist, wrote an article entitled *On The Nonexistence Of Privately Issued Indexed Bonds In The U.S.*, where he explained the absence of indexed bonds which would pay investors a constant real rate of interest plus the rate of

inflation. Professor Fischer discovered that part of the reason some private corporations would not want to issue indexed bonds is that their profits have often been lowest in years of high inflation. He believed that a bond tying its interest payout directly to inflation would exacerbate this negative correlation between company profits and inflation.

Also in the early 1980's in the United States, the director of research at the Federal Reserve Bank of Boston had concluded that there is a need for such bonds, pointing out that they would be a much better investment for inflation protected annuities or defined benefit pension plans than anything then available. In 1984, the administrator of the U.S. Labor Department's Office of Pension and welfare Benefit Programs urged the Treasury to issue inflation-indexed bonds for investments by pension plans. However, these have not been issued. Apparently, these securities have been discussed as having the same structure as the U.K. bonds in which the principal is repaid at maturity.

In 1985, U.S. Patent 4,742,457 was filed and mentioned a security where both the interest and the principal were indexed to inflation. However, there was no description of natural issuers or natural investors in such a security, nor was there any description of a system or method for identifying potential issuers or investors. By 1989, P.S. Spiro in his book *Real Interest Rates and Investment And Borrowing Strategy,* continues to quote Professor Fischer's argument for the absence of indexed bonds, *i.e.,* corporate profits have often been lowest in times of high inflation so that there are no natural issuers of these securities. Mr. Spiro went on to say, "Moreover, the market appears to have come up

with a fairly good substitute for the indexed bond, in the form of the floating rate note. The existence of this instrument, which is in many ways more conventional than indexed bonds, is part of the reason why the market in indexed bonds which Stanley Fischer was looking for in 1977 has failed to materialize. This new instrument shares with the indexed bond the advantages of being issued for a long term and reducing inflation risk, while being a less radical departure from previous practices."

However, while floating rate notes have been considered a substitute for one form of indexed bonds, they do not protect against changes in cumulative realized inflation rates, the prime problem being addressed in this invention. Hence, in spite of a perceived need for indexed bonds, the idea has not made much of an impact in the marketplace.

Shifting the emphasis to the question of financing or borrowing, it will be found that most entities determine borrowing needs in the context of their operating and/or capital budgets. Borrowing on a project basis involves estimating the capital cost of the project and forecasting the likely quantity of sales and consumption of major input items and raw materials. Production estimates are made taking into account sales estimates, production capacity and inventory needs. Prices of the products to be made as well as the cost of the input items are also estimated. Projections of sales and costs in value terms are made and operating cash flows are derived. The financing pattern of the project is then chosen as discussed below. A high inflationary environment limits the maturity of available financing.

Though some finance theoreticians say that the choice of debt or equity (and their various hybrid

f rms) are irr levant in determining the value of the firm, a typical practical appr ach is to choose a level of debt and examine its implications on the variability of cash flows and tax benefits. It is also ensured that covenants attached by the lender are satisfied, for example, a maximum debt-to-equity ratio or an interest coverage ratio. Thus, the method of choosing a financial pattern is often a trial-and-error operation.

Another area of background concerns operating exposure. Four articles which deal with operating exposure are by M. Adler and B. Dumas, *Exposure To Currency Risk: Definition And Measurement, Financial Management,* pp. 41-50 (Summer, 1984); E. Flood, Jr. and D. R. Lessard, *On The Measurement of Operating Exposure To Exchange Rates: A Conceptual Approach,* Financial Management pp. 25-36 (Spring, 1986); D. R. Lessard and J. B. Lightstone, *Coping With Exchange Rate Volatility: Operating And Financial Responses,* Harvard Business Review (March/April, 1986); and E. Flood, Jr., *Global Competition and Exchange Rate Exposure,* Stanford University Graduate School of Business working Paper #837, (September 1985). The first article *Exposure To Currency Risk,* measures exposure at a firmwide level. Exposure is defined as " . . . the amounts of foreign currencies which represent the sensitivity of the future, real domestic-currency (market) value of any physical or financial asset to random variations in the future domestic purchasing powers of these foreign currencies, at some specific future date." One example of measuring exposure uses the regression equation $P = a+b_1S_1+\ldots+b_nS_n+e$ where P denotes the stock price of the firm, S_i denotes currency i for $i = 1$ to n, a is an intercept and e is the error time. The

coefficients b_i give the operating exposures to the vari us currencies. The reader is also warned about the pitfalls of n nstationarity and multicollinearity in estimating the regression equation. To hedge any future cash flow C, the authors suggest selling a quantity $b_i C$ for each currency. They define a hedge as "...the amounts of foreign-currency financial transactions (*i.e.* forward contracting or its equivalent) required to render the future, real, domestic-currency market value of an exposed position statistically independent of unanticipated, random variations in the future domestic purchasing powers of these foreign currencies." Their model, however, is limited to a one-period setting and makes the assumption that P and S are multivariate normal.

The second and third articles say that the firm's operating exposure is determined by two factors, the structure of the markets in which the company sells its products and the structure of the markets in which the company (and its competitors) purchase their inputs. The fourth article derives operating exposure for different industries by analyzing the price elasticities in both types of markets they operate in, the products and the inputs. The last three articles then suggest using a combination of forwards in different currencies to hedge the operating exposures derived by their analyses. These analyses will be compared to that which is disclosed herein in the Detailed Description Of The Preferred Embodiments.

SUMMARY OF THE INVENTION

The problems and deficiencies in the prior art have been recognized and solved by the various systems and methods disclosed herein and including the

creati n of a family of financial instruments comprising a s curity or securities having a multi-period repayment structure which repayment structure is a function of cumulative realized inflation. The invention also includes a method for providing an improved financing system comprising the steps of determining, including assisting in the determination of, that an entity has, including the contemplation of having, an asset with a multiyear life where some measure of the performance of the asset, such as cash flow, is expected to increase at least in part with inflation in a country, when measured in the currency of that country; and issuing, including assisting in the issuance of, an Income Growth Security in the currency of the country to at least partially fund said asset.

Further, the invention includes an improved financing system comprising an entity having an asset, including the contemplation of having the asset, where the asset has a multiyear life and where some measure of the performance of the asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of the country; and an Income Growth Security issued by the entity to at least partially fund the asset, where the repayment structure over many periods matches at least in part some measure of the performance, such as cash flow, of the asset.

The invention also includes a method for providing an improved investing system comprising the steps of determining, including assisting in the determination, that an entity has a desire to fund a future liability which liability is expected to increase at least in part with inflation; and investing, including assisting in the investing, in an

Income Growth Security to at least partially fund the future liability.

Furthermore, the invention also includes a method for providing an improved investing system comprising the steps of determining, including assisting in the determination, that an entity has the desire to invest an amount today to insure an increase in its purchasing power in the future; and investing at least part of this amount, including assisting in the investing, in an Income Growth Security. Furthermore, the invention also includes a method for providing an improved investing system comprising the steps of determining, including assisting in the determination, that an entity has a desire to fund a future annuity, which is required to increase with cumulative realized inflation over a period of time in the future, which may not be bounded at its upper end; and investing, including assisting in the investing, in an Income Growth Security to at least partially fund the future annuity.

Also, within the inventive framework is a method for providing an improved financing system for the borrowing needs of an entity comprising the steps of collecting selected performance data relating to the entity; collecting selected financial data relating to a selected country or countries, such as real exchange rates and cumulative realized inflation rates; computing a regression of the entity's selected performance data on the selected financial data of the country or countries; determining significance between the entity's performance data and the financial data of the country or countries; determining a potential hedge amount; and determining an amount to be borrowed. A further invention is an improved financing system for the borrowing needs of an entity

comprising a computer wherein performance data relating to an entity is stored and collected; selective financial data relating to a selected country or countries is stored; means for computing a regression on the entity's financial data and the country's financial data; means for determining significance of a statistical relationship between the entity's performance data and the country's financial data; means for determining a potential hedge amount; and means for determining the amount of financing using Income Growth Securities.

The invention herein also includes combining the various methods and systems set forth above.

It is an object of the present invention to provide a security which has a multi-year repayment restructure that is a function of cumulative realized inflation. Another object of the present invention is to provide a financing and investing system and method that has natural issuers and investors. yet another object is to provide a security that will pay an investor an amount having a real interest rate component and an amount which is tied to cumulative realized inflation. Still another aspect of the present invention is to provide a financing structure that allows an entity to better match its repayments with some measure of its performance such as cash flow. Yet another aspect is to provide a method that discloses a variety of circumstances in which a measure of performance of an asset, such as cash flow, is expected to increase at least in part with inflation. A still further aspect is to provide a security where the repayment structure spans many periods to match at least in part some measure of the performance of the asset.

A further aspect f. the present invention is t provide an investing system that allows an investor to acquir a real interest rat r turn and a return based on cumulative realized inflation. An aim of the present invention is to provide an analytical system for determining that an entity would benefit from the issuance of Income Growth Securities. Another aim is to define real exchange rate exposures of an entity, to define appropriate issuance of Income Growth Securities by the entity which will manage these real exchange rate exposures and then to find potential investors who would naturally benefit from investing in such borrowing by the entity.

A further object of the present invention is to provide a new security which increases over time in a way that closely matches the increase in future liabilities of a defined benefit pension plan that are expected to increase at least in part with cumulative realized inflation. A further object of the present invention is to provide a new security which allows an investor to preserve a level purchasing power over a period of time. A still further object of the present invention is to provide a new security which allows an endowment or trust to annuitize the value of its assets in real terms over an extended time period.

Another aim of the present invention is to identify potential issuers of Income Growth Securities and to provide a method and system for calculating the future value of the security. Yet a further aspect of the present invention is to provide a new system and method for analyzing an entity's exposure to real exchange rates and inflation rates. Another aspect of the invention is to provide a means for stabilizing an entity's operating mark-up. A further object of the present invention is to allow a pension plan to define

the value of its future liabilities in a consistent way which is independent f an estimate of future inflation although the liabilities are expected to increase at least in part with inflation over time. Other objects, aspects and aims of the present invention will become clearer from a review of the following descriptions and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1(a) and 1(b) are graphs of prior art financing systems illustrating the relationship between cash flows that might be expected from an asset and repayment programs.

Figure 2 is a graph illustrating the financing system disclosed herein showing the matching relationship between the expected cash flows from an asset and the repayment program under an Income Growth Security.

Figure 3 is a block diagram of a database structure useful for identification of relevant industries and firms. The data is arranged in a hierarchial fashion but can be organized in a network or relational structure if desired.

Figure 4 is a block diagram of an overview of a financing and investing system and method.

Figure 5 is a block diagram of the system and method illustrating an example of a test in the identification of an industry where that industry is facing foreign competition.

Figure 6 is a block diagram of the system and method illustrating another example of a test in the identification of an industry where that industry is facing foreign competition.

Figure 7 is a block diagram of the system and method illustrating th first test in the

identificati n of an industry where that industry has costs of inputs affected by foreign suppliers.

Figur 8 is a bl ck diagram f the system and method illustrating another example of a test in the identification of an industry where that industry has costs of inputs affected by foreign suppliers.

Figure 9 is a block diagram of the system and method illustrating an example of the identification of an industry where that industry has operating profits or price indices tied to domestic inflation.

Figure 10 is a block diagram of the system and method illustrating an example of the identification of an industry where that industry has costs tied to domestic inflation.

Figure 11 is a block diagram of the system and method illustrating an example of the identification of a firm where that firm faces foreign competition.

Figure 12 is a block diagram of the system and method illustrating an example of the identification of a firm where that firm has costs of inputs affected by foreign suppliers.

Figure 13 is a block diagram of the system and method illustrating an example of the identification of a firm where that firm has operating profits or price indices tied to domestic inflation.

Figure 14 is a block diagram of the system and method illustrating an example of the identification of a firm where that firm has costs tied to domestic inflation.

Figure 15 is a block diagram illustrating an overview of a performance simulation system and method.

Figure 16 is a block diagram illustrating an example of a performance simulation system and method for a domestic manufacturer facing foreign competition.

Figure 17 is a block diagram illustrating an example of a performance simulation system and method for a manufacturer with costs of inputs affected by foreign suppliers.

Figure 18 is a block diagram illustrating an example of a performance simulation system and method for a domestic manufacturer with operating profits tied to domestic inflation.

Figure 19 is a block diagram illustrating an example of a performance simulation system and method for a domestic manufacturer with costs tied to domestic inflation.

Figure 20 is a chart illustrating a total active lives liability and a riskless matching asset.

Figure 21 is a block diagram illustrating an analysis by investors with future obligations which are expected to increase with cumulative realized inflation.

Figure 22 is a block diagram illustrating an analysis by investors with savings who desire to increase the purchasing power of the savings.

Figure 23 is a block diagram illustrating an analysis by investors with endowments who desire to maintain constant gift giving programs.

Figure 24 is a graph illustrating the historical relationship between the price of electricity obtained by Ontario Hydro, a Canadian electrical utility, and cumulative realized inflation in Canada.

Figure 25 is a graph illustrating the relationship between the average sales for each

McDonald's restaurant which is at least one y ar old and cumulative realized U.S. inflati n.

Figure 26 is a graph illustrating the relationship between the actual dollar price in the U.S. and an estimated dollar price of pulp based on U.S.-Swedish real exchange rates.

Figure 27 is a graph illustrating the relationship between the GNP Price Deflator and wage levels in the U.S.

Figure 28 is a block diagram, illustrating an example of a test to check the relationship between an entity's wage inflation and domestic inflation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the present invention is susceptible of different models, various modifications, alternative forms and other detail, specific embodiments thereof are shown by way of example in the drawings and are herein described in detail. It should be understood, however, that it is not the intention to limit the invention to the particular models, forms and details disclosed, but on the contrary, the intention is to cover all models, modifications, forms, details, equivalences and alternatives falling within the spirit and scope of the invention as expressed in the appended claims.

In order to more clearly understand the subject invention, the first portion of this description details Income Growth Securities, other definitions, equipment and software, mathematics and database design. Thereafter a framework for the issuer and investor sides of the structural systems and methods disclosed herein is provided. There is a detailed description illustrating the identification of suitable industries and suitable firms who would

benefit fr m the systems and methods discl sed herein. There is a d tailed description for measuring operating exposure and its management by a financing structure using Income Growth Securities and a description of the simulation process used to evaluate the financing structure.

Another focus of this Description is to provide structures and methods for identifying industries and then firms within an industry which face operating exposure and who will benefit from issuing the new financing instruments.

The structures and methods also provide a mechanism for evaluating the recommended financing systems. It does this by first generating various alternate economic scenarios in terms of future movements in exchange rates, inflation rates and interest rates and simulating the performance of alternate financing recommendations. It then evaluates this performance in light of a firm's strategic objectives, preferences and financing constraints, and, if necessary, by an iterative process tailors the recommendations to satisfy them.

On the borrowers'/issuers' side, the structures and methods provide for an ongoing revision of the financing recommendations based on periodic updates of database items, evaluation of fundamental changes in the structure of the market and revision of a firm's objectives and financing constraints. In this application, the terms borrower(s) and issuer(s) are used interchangeably. Then potential investors are described who may be interested in securing real returns. For example, such potential investors may be insurance companies, pension plans, endowment funds, superannuities and people who are planning to save for their retirement.

Th structures and methods further provide f r matching th issuers f the new financing instrument with pot ntial investors in the same instrument, although issuers and investors satisfy different needs by coming together in the context of the same transaction. In this way economic reality is squarely addressed and accommodated.

A. Income Growth Securities

Real rate of interest instruments, which will be called *Income Growth Securities,* are defined as securities which pay an amount at time t which is greater than the amount paid at $t-1$ by the amount of inflation from $t-1$ to t, which we shall designate i_t, or by the amount of inflation in some earlier period from time $t-1-d$ to $t-d$, which we shall designate i_{t-d}, where for example, the lag of d periods takes into account the delay in the publication of inflation data.

The cash flows of Income Growth Securities are as follows:

$D(1 + I_{T-d})$ at the end of T periods,

$D(1 + I_{T+1-d})$ at the end of the $T+1$ periods,

$D(1 + I_{T+2-d})$ at the end of the $T+2$ periods,

and

$D(1+I_{T+N-d})$ at the end of $T+N$ periods,

where D is a constant amount of money, I is cumulative realized inflation expressed as a fraction from the end of d periods before the effective start of the transaction for which the security was issued to the end of $T-d$ periods for the payment made at the end of T periods, the first payment is made at the end of T periods and payments are made at the end of every period thereafter to the final payment of the transaction at $T+N$, where N may be finite or infinite.

By way of example, if inflation is calculated with a lag of 2 quarters, so that d is equal to 2 and a period is defined as a quarter, the payment made at the end of 10 quarters is calculated on the basis of cumulative realized inflation from 2 quarters before the start of the transaction to 8 quarters after the start of the transaction.

Income Growth Securities may include the following special types by example. In a particular case, $T=1$, and payments start at the end of the first period. If N is infinite, we have perpetual types Income Growth Securities and if the real interest rate is constant, D is equal to the principal multiplied by the real rate of interest. Inflation may be measured at the level of a country or group of countries or at the level of a part of a country or at the level of an individual firm or product. We may note that

$$\frac{\textit{payment at the end of the period } t}{\textit{payment at the end of the period } (t-1)} = \frac{D(1+I_{t-d})}{D(1+I_{t-1-d})} = (1+i_{t-d})$$

The present value of a perpetual type security with the above payment stream with no lag may be shown to be

$$\frac{D}{r},$$

if r is a constant real interest rate. The present value of a perpetual type security may also be readily calculated if the real interest rate is not constant. For example, if the real interest rate is r_1, for the first T periods and r_2, thereafter, we may show that the present value with no lag to be

$$\frac{D}{r_1} + \frac{D}{(1+r_1)^T}\left[\frac{1}{r_2} - \frac{1}{r_1}\right].$$

We may define a repayment rate at the time of any given repayment as the repayment amount expressed as a

fraction of the original pr sent value of the security. The r payment rat s ar shown bel w:

$r(1 + I_1)$ at the end of period one,

$r(1 + I_2)$ at the end of period two,

$r(1 + I_3)$ at the end of period three, and

$r(1 + I_t)$ at the end of period t.

In a traditional financing structure, whether the borrowing is at fixed or variable nominal interest rates, the repayment amount does not match the earnings ability of a long lived asset, where these earnings will typically increase at least in part with inflation. For example, if a state agency borrows money to finance a water tunnel, the revenues will be expected to increase with inflation over a long period of time. By financing in a conventional structure of borrowing, the financing costs do not match the earnings ability of the asset. In relation to the earnings ability of the asset, the borrower is front loading his financing cost, in the sense of paying too high a financing cost in the early years and too low a financing cost in the outpost years. This may put the viability of the enterprise at risk in its early years, when the financing cost is highest as a fraction of the earnings ability of the asset. This may be seen graphically in Figure 1(a) where line 10 representing cash flows from the asset may increase with inflation over the years while line 12 representing one type of typical debt service structure will be a horizontal line, which is constant over time. Alternatively, the debt service structure 12a may decline over time as shown in Figure 1(b), which will be an even poorer match with the increasing cash flow 10a from the asset. The importance of the mismatch between the financial performance of the asset and the debt service structure will be greatest for long lived capital intensive entities. If a long lived asset such as a water tunnel is financed using long maturity finite type Income Growth Securities, the repayment rates in

the early years of the financing will be much l wer than c nventional market rates f interest. However, the repayment rates in the outpost years of the financing will be higher. This pattern of debt service is expected to match revenues received from the water tunnel.

By properly matching the financing cost to the financial performance of the asset, by using a perpetual type or finite type Income Growth Security for the borrowing structure, the borrower may achieve a low repayment rate in the early years of the repayment, when the earnings ability of the asset has not yet benefitted from inflation and have a higher repayment rate when the asset is best able to handle larger payments. Borrowers which possess the foregoing characteristics are *natural issuers* of Income Growth Securities. This may be shown graphically in Figure 2 where the line 14 is identical to line 10 of Figure 1 but where the line 16 illustrates the repayment structure of an Income Growth Security.

In some cases, such as hydroelectric utilities or commercial real estate, the earnings ability of the asset may be contractually determined to increase with cumulative realized inflation. In other cases, the future earnings power of the asset is not contractually established at the time of the transaction but an earnings stream which increases with inflation may be the best estimate of the future earnings power. This may be true for unregulated and regulated entities. For example, the prices that a regulated utility obtains for electricity may closely increase with cumulative realized inflation over time. For example, Figure 24 shows the historical relationship between electricity prices 470 charged by Ontario Hydro, a Canadian utility, and cumulative realized inflation 472 in Canada.

A corporation contemplating an acquisition may typically assume, for example, that the new operation will generate increasing cash flows over time. Furthermore,

securities; however, these zero coupon securities may not be used to constitute the perpetual or finite type Income Growth Securities.

In the sense that the repayment amounts with an Income Growth Security match the earnings ability of the asset being financed, the security has some characteristics of an equity security. It may in fact be structured as a preferred or debt security. We shall later describe further examples of natural issuers and investors of Income Growth Securities, in the sense of matching the earnings ability of an asset with such securities' repayment structure in the case of an issuer and matching the future liabilities of an investor with the income to be earned on such a security. It should be understood, however, that the types and natures of transactions are also unlimited and it would be impossible to list them all here. Nevertheless, the concepts just expressed will have far reaching effects and offer the financial community a new and exciting tool to analyze financing and investing arrangements.

Derivative securities are securities whose payoffs are functions of some underlying securities. There are two broad classes of derivative securities, options and forwards/futures. options include call options and put options, for different maturities and strike prices on all types of underlying in Income Growth Securities mentioned above. Derivative securities may also include any futures and/or forwards of differing maturities that may be issued on the underlying Income Growth Securities. Derivative securities also include any derivatives whose underlying security are other derivatives described above. For example, options on futures and/or forwards are also contemplated. Moreover, swaps may also be considered as possible derivative security. A good textbook reference for derivative securities is Cox et al. *Options Market* (Prentice Hall Inc., 1985).

Issuers and investors can accomplish their respective goals as described earlier either by exchanging the underlying Income Growth Securities or by exchanging derivatives on these underlying Income Growth Securities. We will describe the detail embodiment of the invention in terms of underlying Income Growth Securities, but it will be obvious to those skilled in the art that the same objectives may be accomplished by use of the appropriate derivatives. We therefore broaden our definition of Income Growth Securities to include these derivatives.

B. Other Definitions

The systems and methods disclosed herein are also designed to identify, measure and manage *operating exposure,* and operating exposure can be defined to be the changes in some measure of the performance of the firm, such as operating cash flow, due to changes in exchange rates and/or inflation rates, domestic and/or foreign. A firm or entity is *determined to be exposed* if it is shown to have operating exposure using the techniques described in Section D below. The term operating *profit* may be defined to be net sales less cost of goods, sales expense and general administrative expense. *operating cash flow* may be defined as the operating profit adjusted for some non-cash transactions; it would, for example, exclude sales which have been credited but have not yet been paid for. These terms and concepts are explained in G. Foster, Financial *Statement Analysis,* (Prentice-Hall,1986). These two terms, operating cash flow and operating profit may be used interchangeably. *operating margins and operating markups* are ratios. The former is defined as operating profits divided by net sales and the latter is operating profits divided by the cost of goods sold, sales expense and general administrative expenses. Operating profit, operating cash flow, operating margins, operating markups and revenues are some examples of the

measure of the performance f an asset or ntity. The inflation rates refer to general inflati n rates of selected countries. Some articles that have discussed operating exposure are those already mentioned, *Coping With Exchange Rate Volatility: operating And Financial Responses; On The Measurement of Operating Exposure To Exchange Rates: A Conceptual Approach; and Exposure to Currency Risk: Definition And Measurement.*

As mentioned, in this description attention will first be directed to the borrower side of the systems and methods discussed. A main focus is to provide a framework for measuring operating exposure and then recommend financing structures to hedge this operating exposure. one of the objectives here is to try to dampen the fluctuations in operating markups/margins arising from changes in exchange rates and/or inflation rates. The financing structure involves the use of Income Growth Securities which guarantee a real rate *of interest*. A real rate of interest may be defined as the *nominal interest* rate less the inflation rate, and the nominal interest rate is the one normally quoted in newspapers. For an academic description regarding real rates of interest see Z. Bodie, et al., *Investments* (Richard D. Irwin, Inc., 1989).

C. Equipment and Software

For a single company analysis the system can operate on a stand-alone microcomputer. Relevant subsets of a database can be downloaded from a main frame and be maintained on the microcomputer. Software has been primarily designed to operate in the microcomputer environment, though for obvious reasons it runs more efficiently on a mainframe. However, minicomputers, workstations, etc. may also be used. For simultaneous multiple use with a centralized database, there may be a need to work with a network of computers, with several

fr ntends linked to a mainframe. To preserve and maintain data integrity, a centraliz d database should be n the mainframe. M st of the analysis in this environment can still be done on the frontend microcomputer but tasks requiring intensive computation such as simulations and special statistical analysis should be done on the backend, at the main frame.

Because of involved statistical calculations, simulations and a large amount of data required to be stored in an efficient easily accessible manner, the computer hardware is an integral part of the systems, methods and structures described.

Software packages are commercially available and may be purchased from different sources and can be used to maintain and analyze data and for presentation of results. As an example of software for database management, D-BASE IV brand software may be used to store and maintain data on the front end. For statistical purposes, examples of commercially available programs are RATS, SHAZAM, SAS and CSS brands software programs. These may be used to establish time series and regression relationships. Examples for spreadsheet and charting are EXCEL and POWER POINT brand software programs. These may be used for the presentation of results. For networking, DYNACOMM and TSO brands operating systems may be used to transfer data to and from a microcomputer and a main frame and may be used to connect to the main frame.

D. Overview of the Mathematics

An overview of the mathematics involved will be instructive and may act as a reference when reviewing the additional disclosure below. We will present the overview of the mathematics in two parts. In Part D.1, we will discuss the case of a purely domestic issuer, who issues Income Growth Securities in his home currency. In Part D.2,

we will discuss the more general case, when we have to include a consid ration f international issues. Notwithstanding the generality of circumstanc s discussed in this section and the variety of different problems faced by issuers and investors, the systems and methods in all cases will involve the issuance of and investment in Income Growth Securities.

D.1 PURELY DOMESTIC ISSUER

In many cases, some measure of the performance of a firm, such as its operating cash flow or its revenues, will closely increase with cumulative realized inflation. In other cases, the measure of performance, after the fact, may not turn out to have increased with cumulative realized inflation, but before the fact, this is the best expectation of future performance. In yet other cases, the measure of performance will increase or is expected to increase by a constant amount per year relative to inflation.

The mathematical expressions of these relationships and the mathematical description of the statistical testing procedure to identify whether an entity is a natural issuer of Income Growth Securities are presented in Sections F.3 and F.6 following.

D.2 ISSUER-GENERAL CASE

In this general case, a potential issuer is concerned with exchange rate effects on his performance, whether or not the entity is engaged in foreign operations or sales.

A real exchange rate hedge is defined to achieve a constant operating margin or operating markup that would have been achieved except for a deviation from the *purchasing power* parity existing at the start of the period. For a formal description of this parity, reference may be made to i.o. Grabbe, *International Financial Markets,* pp.

169-171 (Elsevier Science Publishing Co., Inc., 1986). However for purposes here purchasing power parity means the exchange rate at which one country's price level equals another country's price level.

A simple two period real exchange rate hedge is composed of two legs. The first involves borrowing (or lending) a foreign currency principal amount

$$\frac{A^F}{1+r}$$

at the start of the period and paying (or receiving) an amount $A^F(1+I^F)$ at the end of the period, where I^F is the cumulative foreign inflation rate, r is the real interest rate and A is a constant. The second leg involves lending (or borrowing) an equivalent domestic currency principal amount expressed

$$\frac{A^H}{1+r}=\frac{A^F/S_0}{1+r}$$

where S_0 is the current spot exchange rate at the start of the period and the superscript H is the home country, and receiving (or paying) an amount $A^H(1+I^H)$ at the end of the period, where I^H is the cumulative domestic inflation rate.

The net result at the start and the end of the period of this simple two country, one period transaction is

$$\frac{-A^F-A^HS_0}{1+r} = 0$$

at the start and

$$-A^F(1+I^F)+S_0A^H(1+I^H)/S_t$$

at the end where the subscript t denotes time.

The calculation of the cumulative inflation rate may be illustrated as follows. The Consumer Price Index in the U.S. for 1970 and 1980 was 38.8 and 82.4, respectively. Hence, the cumulative inflation rate between 1970 and 1980 was 82.4 divided by 38.8 minus 1 and is equal to 1.12 expressed as a fraction or 112 percent. The *cumulative*

realized inflation is the rate which has actually occurred, distinguished from th rat which at the start of the period is expected to occur.

An example of the results of the hedge are reviewed under different scenarios with the following implicit assumptions:

(a) The model is a discrete time period model. The price setting process is deterministic.

(b) The objective function implicit in the model is the maintenance of a constant operating markup/margin.

(c) The pricing structure of the market is such that the domestic prices for the product are determined by the *market power* of suppliers from different countries, the inflation in product prices in those foreign countries and the nominal exchange rate. As will be discussed later the last two items may be collapsed into the *real exchange* rate. As mentioned, the nominal exchange rate is the exchange rate that is popularly known and is the rate usually referred to in the newspapers. For a formal description of the nominal exchange rate, reference may be made to *International Financial Markets*.

(d) Real interest rates are constant over the time horizon and are equal across countries.

(e) The *Law of One Price* (hereinafter "LOP") holds in the initial period. This Law essentially says that the price of selected goods are the same across all countries after exchange rate conversion. See *International Financial Markets*, p. 167 for details.

Assumption (c) arises out of the specification of the price setting abilities of competitors from different currencies. Assumptions (d) and (e) are relatively minor in the sense that we can eliminate them by modifying the objective function specified in assumption (b) to be an operating markup/margin that would have been attained except

for a deviation from purchasing power parity. Constancy of real rates across time has been eliminated in the more general model given below.

Modifications to the real hedge can be made when either the prices and/or the costs do not move identically with general inflation (i.e. one to one) but move at a constant times the general inflation rate.

In this context it can be shown how, by using the real exchange rate hedge, the effects of deviations from parity on the performance of the entity can be nullified. The terms *domestic country and home country* are used interchangeably. For any one firm its domestic country will be the country in whose currency it measures its income, its assets and its liabilities. Almost always, the home country for most firms is self evident. For example Germany is the domestic country for Daimler-Benz and Japan is the domestic country for Sony.

Making the assumptions listed above, the following points are addressed here in the Mathematics Overview. For the exporter or domestic manufacturer facing foreign competition, the general hedge for a multiple country, multiple goods case is illustrated as *Case I*. A measurement of operating exposure is derived for the case where the input costs are affected by foreign suppliers and will be referred to as *Case II*. A *foreign competitor* is an entity for whom the country in which the industry/market being analyzed is not the *domestic country*. For example, General Motors would be a foreign competitor when analyzing the pricing structure of the Japanese car market and Toyota is the foreign competitor when analyzing the pricing structure of the U.S. car market. For the examples in this description, the U.S. is the *domestic country*.

Focus is now directed to a generalization of the hedge and some of the statistical issues involved. The generalization of the real exchange rate hedge for *Case I*

will be review d first. For ev ry period t f the time horizon und r consideration, the following price setting process is assumed

$$p_T^H = P_0^H(1+I_T^H)\ (1-\sum_{K \neq H} a^k) + \sum_{K \neq H} a^k P_0^k \frac{(1+I_t^K)}{S_t^k} \qquad (1)$$

where

$$p_T^K$$

is the product price in a country k at a time t. Time t = 0 is the beginning of the time period under consideration, and $k=H$ denotes the home country. The symbol

$$I_t^k$$

is the cumulative general inflation rate from time 0 to time t. The superscript k denotes country k. The symbol a^k is the market power of a country or currency k. The market power is some indication of price setting ability. The market power has to be non-negative and the total of all market powers has to sum to one, when summing over all countries, including the home country. The symbol

$$S_t^k$$

is the nominal exchange rate for currency k at time period t. By convention the rate has the home currency in the denominator, such as, so many yen per dollar.

The generalized hedge per product unit involves the following two legs for each currency k and each time t. In the first leg, a firm borrows an amount equal to:

$$\frac{a^k P_0^k}{(1+r_t^k)}$$

where r_t^k

is the real interest rate in country k from time 0 to time t. This would mean that the firm will pay back

$$a^k P_o^K (1+I_t^k)$$

at the end of the borrowing period. The real rate of interest is approximately defined as the nominal interest rate less the inflation rate.

In the second leg of the hedge, the firm converts the borrowed amount to its home currency, thus obtaining

$$\frac{a^k p_o^K}{(1+r_t^K) S_o^k}$$

and it invests this amount in a domestic Income Growth Security. At the end of the period, the firm receives

$$\frac{a^K p_o^H (1+r_t^H)(1+I_t^H)}{(1+r_t^k)}.$$

In this derivation we have used assumption (e), namely that the LOP gives

$$\frac{p_o^k}{S_o^k} = p_0^H.$$

Using assumption (d), that of equality of real interest rates across countries, the sum received at the end of the period is

$$a^k p_o^H (1+I_t^H).$$

The hedge financing structure described here is a net zero transaction at the start of the period. What was borrowed in the foreign Income Growth Security is exactly what was invested in the domestic Security after conversion at the exchange rate at the beginning of the period. Then the net result of the hedge, for each currency, at the end of the period t is given by the equation

$$a^k p_o^H (1+I_t^H) - \frac{a^k p_o^K (1+I_t^k)}{s_t^k} \qquad (2)$$

Combining equations (1) and (2), after summing up across the currencies/countries for each period t, shows the following cash inflows for each product unit

$$P_t^H = P_0^H(1+I_t^H)\left(1-\sum_{k\neq H} a^k\right) + \sum_{k\neq H} a^k P_0^K \frac{(1+I_t^k)}{S_t^k} \qquad (3)$$

$$+\sum_{k\neq H} a^k P_o^H(1+I_t^h) - \sum_{k\neq H} \frac{a^k p_o^K(1+I_t^k)}{S_t^k}$$

Canceling the second and fourth terms on the left hand side of the equation and using the fact that the market powers over all countries, including the domestic country, have to equal one, the desired result for each period t is

$$P_t^H = P_0^H(1+I_t^H). \qquad (4)$$

Based on the assumption for *Case I*, that the costs have increased at the domestic inflation rate for each time t, a constant operating margin for each time period is obtained.

The generalization of the real exchange rate hedge for *Case II* is now discussed. This is the case of a domestic manufacturer whose input costs are affected by foreign suppliers. Such conditions exist in the paper and pulp industry, for example. For every time t of the time horizon the following cost setting process is assumed

$$C_t^H = C_0^H(1+I_t^H)\left(1-\sum_{k\neq H} b^k\right) + \sum_{k\neq H} b^k C_0^k \frac{(1+I_t^k)}{S_t^k} \qquad (5)$$

where

$$C_t^k$$

is the cost in country k for time t; time $t=o$ is the start of the time period under consideration, and $k=H$ denotes the home country. The symbol b^k is the market power of country or currency k. The market power is some indication of the price setting ability of suppliers in country k of the input item. As before, the market power has to be non-negative and all countries' market powers have to sum up to one. The symbol

$$S_t^k$$

is the nominal exchange rate for curr ncy k, at time t.

Th generalized hedge per pr duct unit involves th following two l gs f r each currency k and each time period t. The firm lends an amount equal to

$$\frac{b^k C_0^k}{(1+r_t^k)}$$

in the first leg where

$$r_t^k$$

is the real interest rate in country k for time t. This would imply receiving

$$b^k C_0^k (1+I_t^k)$$

at the end of the borrowing period.

In the second leg, the above loan amount may be financed by borrowing

$$\frac{b^k C_0^k}{(1+r_t^k) S_0^k}$$

in the home currency through the issuance of a domestic Income Growth Security. At the end of the period, the firm receives

$$\frac{b^k C_0^H (1+r_t^H)(1+I_t^H)}{(1+r_t^k)}.$$

In this derivation, assumption (e) is used, namely

$$\frac{C_0^k}{S_0^k} = C_0^H.$$

Using assumption (d), the equality of real interest rates across countries, the pay back at the end of the period is

$$b^k C_0^H (1+I_t^H).$$

Observe that the real hedge is a net zero transaction at the start of the period in the sense that the amount invested in the foreign Income Growth Security is equivalent to what was borrowed in the d mestic currency

after conversion at the exchange rate at the beginning of the period. The net result of the hedge for each currency at the end of the time t is

$$\frac{b^k C_0^k (1+I_t^k)}{S_t^k} - b^k C_0^H (1+I_t^H) . \qquad (6)$$

Combining equations (5) and (6) after summing up across the currencies/countries for each time t the following cash outflows per product unit is obtained

$$C_t^H = C_0^H (1+I_t^H) \left(1-\sum_{k \neq H} b^k\right) + \sum_{k \neq H} \frac{b^k C_0^k (1+I_t^k)}{S_t^k}$$

$$+ \sum_{k \neq H} b^k C_0^H (1+I_t^H) - \sum_{k \neq H} \frac{b^k C_0^k (1+I_t^k)}{S_t^k} \qquad (7)$$

By canceling the second and fourth terms on the right hand side of the equation and using the fact that the market power over all countries including the domestic country is equal to one, the desired result for each time t is

$$C_t^H = C_0^H (1+I_t^H) .$$

Based on the assumption for *Case II*, that the prices have increased at the domestic inflation rate, for each period t, a constant operating margin is achieved.

By multiplying both sides of equation (5) by -1 and adding P_t^H to both sides the equation is

$$P_t^H - C_t^H = P_t^H - C_0^H (1+I_t^H) \left(1-\sum_{k \neq H} b^k\right) - \sum_{k \neq H} \frac{b^k C_0^k (1+I_t^k)}{S_t^k} \qquad (9)$$

Dividing both sides by P_t^H and using $P_t^H = P_0^H (1+I_t^H)$ the equation becomes

$$\beta_t = \beta_o + (1-\beta_o) \sum_{k \neq H} b^k - (1-\beta_0) \sum_{k \neq H} b^k (1+e_t^k) \qquad 10)$$

where

$$\beta_t \equiv \frac{P_t^H - C_t^H}{P_t^H}$$

is the operating margin for time t and

$(1+e_t^k)$

is defined to be the real exchange rate, with

$$(1+e_t^k) = \frac{S_o^k(1+I_t^k)}{S_t^k(1+I_t^H)}.$$

From (10), we obtain the following equation to be estimated by a restricted regression

$$\beta_t = \beta_o - (1-\beta_o)\sum_{k \neq H} b^k e_t^k. \qquad (11)$$

The following texts reference the theory and the estimating procedures used here: G.G. Judge, et al., *Introduction To The Theory And Practice Of Econometrics,* (John Wiley & Sons, 1988) and W.H. Press, et al., *Numerical Recipes* (Cambridge University Press, 1989).

The firm may believe that useful information about the future nature of the competitive environment may be obtained by a statistical analysis of historical profitability. In such cases, some statistical issues in the estimation of the model are briefly mentioned here. The regression equations of the type given in equation (11) have to be estimated in a way which satisfies the restriction that the market powers for all the countries, including the domestic country, equal one, or alternately the market powers of the foreign countries should be less than one, and the market powers should be non-negative. Using time series level data often leads to high autocorrelation. There are common procedures to tackle this problem. Two references are G.E.P. Box et al., *Time Series Analysis, Forecasting and Control* (Holden-Day Inc., 1976); and W.A. Fuller, *Introduction To Statistical Time Series* (John Wiley & Son, 1976). The market power coefficients may also vary across time. one way to address this problem may be to use a varying coefficients regression. We also have to address the pr blem of nonstationarity. See *Introduction To The*

Theory And Practices Of Econometrics. Lastly as a validating technique, two alternate approaches are ften used to measure exposure and will be discussed below.

E. Database Design

An overview of the database design is illustrated in Figure 3. Data is stored hierarchically but it can be stored in a network or relational structure. Publicly available data is used for most phases of the system. It is used to identify industries which can use the structures and methods disclosed herein and can benefit from borrowing and/or lending in the inventive real interest rate structure. It can also be used to identify firms within those industries which can use the systems and methods disclosed herein. The data can also be used to make an initial recommendation of a financing/hedging structure.

Internal financial and accounting data is used to supplement publicly available data in the specification of a financing structure and objectives of the firm. Adjusting accounting data to reflect economic reality is a subjective process. For some adjustment techniques see Foster. G. *Financial Statement Analysis,* (Prentice-Hall, 1986). Different ways of representing a database are explained in a textbook by Aho et al., *Database Structures and Algorithms (1983)*.

F. Analysis for Issuers

Reference will now be made to the drawings for a greater and more in-depth view of the structural systems and processes included in the invention here as expressed by the claims. once again there is no intention to limit the invention in any way. Examples are given for illustrative purposes only and are not to be considered restrictive or encompassing. As provided by statute, only the claims define the scope of the invention herein.

Referring now to Figure 3, the data collection activity to f rm the database carried by the computer hardware may be broken down as shown. First, in block 18 there is diagrammatically displayed the collection and storage of economic and financial data. By economic data, it is meant that there is a collection of general inflation indices and specialized inflation indices on a country as a whole on a cumulative and per period basis, for example, the collection of wage indices. Financial data in a given country includes economic data and returns on various fixed rate and other debt and equity instruments and exchange rates. Block 20 is a collection and storage of data on potential investors in different currencies who may be interested in securing real returns. For example, such potential investors may be insurance companies, real estate entities, superannuities, pension plans, endowments and individuals planning for their retirement and who wish to preserve the purchasing power of their savings.

Block 22 relates to industry-wide data and would be a collection and storage of financial statement items and other such items as production indices, major firms in a selected industry, industry specific inflation indices, cost indices of major inputs to manufacturing, estimate of transportation costs, the ratio of foreign to domestic sales, the ratio of foreign to domestic sourcing and major cost items from major suppliers.

Block 24 represents a collection and storage of data relating to specific firms including financial statement items and data concerning selling and purchasing arrangements with special reference to pricing, quantities and payment provisions, capital and operating budgets, strategic objectives and operating markup/margin stability preferences by product line and geography, market competition from domestic and foreign competitors and the extent of domestic and foreign sourcing. In addition, there

will be a collection of accounting data of past performance including but not limited to product-wise and country-wise sales in value and volume terms, operating costs and major input costs in value and volume, details of existing financing structures, relevant markets and competition and sourcing of major items. It is recognized that only some of these items will be available in any given case. The list of items is given for illustrative purposes.

Figure 4 provides an overview of the basic structural framework and method for the financing and investing systems disclosed herein. The major portions of the system along with the data they process are given by the use of a series of representative blocks. Block 26 on the borrower/issuer side involves identifying target industries which may, for example, have revenues which are likely to increase with inflation or which need to better manage their operating exposure,. that is exposure to changes in exchange and/or inflation rates. once the industries have been selected, there is a need, as shown in block 28, to identify target firms within the industry which could use the borrowing structure disclosed above, for example, to manage their operating exposure in a better way.

An initial recommendation of financing structure is made based on the analysis of publicly available data and a simulation, block 30, is performed to evaluate the financial performance of the firms with this borrowing structure. The measures used to evaluate performance could for example focus on the variability in the markup/margins of the firm or the level of such markup/margins. Next there is a detailed analysis of the firm which may use data that is available internally within the firm. This stage would involve trying different financing policy recommendations and fine tuning them to the needs of the firm. It *is entirely possible for the analysis to start at this point.* This would happen if, for example, a firm directly

appr ached a financial institution and asked for its perating exposure t be identifi d.

The detailed analysis may start, for example, by obtaining future operating cash flows, block 32, and determining the firm's borrowing needs and then estimating repayments with traditional financing methods, block 34. This is then contrasted with a determination of borrowing needs and an estimation of repayments using Income Growth Securities, block 36. Thereafter operating cash flows are obtained, after interest payments, for different alternatives and a choice based on the targeted firm's preferences is made, block 38.

Note should be taken that once Income Growth Securities are well known and the systems and methods disclosed in this patent have become common knowledge among those skilled in the art, the starting point for an analysis may occur at a later stage or the initial step in the analysis may not be clearly defined. For example, an analysis using traditional methods may be obviated altogether. Or, selected firms may begin keeping certain data as part of their accounting systems so that certain short cuts in the overall analysis become commonplace.

There is also a need to identify investors, block 40, who have a need to invest in Income Growth Securities. As shown in block 42 there is an actual matching of potential issuers of Income Growth Securities with the investors for such Securities.

Block 44 illustrates the possible evaluation of the transaction using *derivative securities* and other special features included in the general definition of Income Growth Securities as an alternative to transactions using the underlying security. These derivative securities have been previously discussed in Section A. Periodic revision of the finance/investing structure will take place once it has been initiated, as shown by block 46.

Th collection of data as described in Figure 3 will also lead to th analysis and identification of investors who have objectives of securing real interest rate returns. In addition there would be an identification of the amounts of investment needed, the desired currencies required, and the maturities required. Thereafter, there is a match of borrowers and investors and final details of a transaction will be completed.

An analysis of three cases of industries/firms is described in more detail. *Case I* is a domestic industry with substantial foreign competition such that the output prices in the domestic market are influenced by changes in real exchange rates of those foreign countries; e.g., in the automobile industry there is some ability for Japanese car manufacturers to set car prices in the U.S.

Case II is an industry whose costs are set primarily by the real exchange rates of some foreign countries whose suppliers dominate in the world market. An example is the paper market, where prices for pulp, a raw material for the paper industry, may be influenced by real exchange rates between the U.S. and the Scandinavian countries. Figure 26 illustrates the relationship between the actual dollar price 462 in the U.S. and an estimated dollar price of pulp based on U.S.-Swedish real exchange rates 460.

Case III is an industry or a firm or an asset, in which some measure of performance, such as cash flow or revenues, increases at least in part with its domestic cumulative realized inflation. Four examples may be franchise companies in the restaurant industry, hydroelectric utilities, acquisitions of other entities and the capital of a financial institution.

The systems and methods of this invention are applicable in countries which are expected to have high or low rates of inflation. The expectation of a high rate of

inflation, in excess of 20 p rcent per year, has traditi nally limited the availability of longer term financing using traditional structures.

1. Case I - Industry

The systems and methods for identifying an industry can be based on a knowledge of the future environment, on a stand alone basis, or can otherwise be obtained by an examination of the past, for example, using the following tests. Referring to Figure 5, an industry is chosen, block 50, and publicly available industry-wide performance data, such as aggregate sales and operating profit data, as specified in block 22 of Figure 3, are obtained. These data are represented by block 52. The exact specifics of the data collected in box 52 will be dependent on the nature of the industry and the firm. Thus for firms with product lines which have different market structures, data should preferably be obtained for the various product lines. This product-wise data will be aggregated across firms to obtain industry data. There could be other adjustments related to differing classification procedures for similar expense items, inventory valuation methods, etc. For some adjustment techniques see Foster. *G. Financial Statement Analysis,* (Prentice-Hall,1986). The data obtained are net sales data and operating profit data on an annual or quarterly basis and the adjustments necessary may be due to differences in accounting methods, structural changes, etc., to insure proper aggregation and time series analysis. The first period of the data is defined to be the base period

$$a^t = \frac{operating\ profit}{cost\ of\ goods\ sold}.$$

The operating markup for each of the time periods for which there are data is also computed, block 54. Past aggregate operating markups are computed for each period t,

where $t = 0$ at the start of th tim period und r consideration, acc rding to the f llowing relationship

$$a^t = \frac{operating\ profit}{costs\ of\ goods\ sold}.$$

Past currency rates (also called nominal exchange rates) and past cumulative realized inflation indices from the base period are obtained, blocks 56 and 58, respectively. At the beginning

$$I_o^k$$

is equal to 0, for every k.

The past real exchange rates are computed using the formula

$$1+e_t^k = \frac{S_o^k(1+I_t^k)}{S_t^k(1+I_t^H)}.$$

Block 60 shows the measurement of operating exposure for *Case 1*. It seeks to measure market power. As mentioned earlier, the term market power in *Case I* for a domestic manufacturer facing foreign competition is defined as a measure of the price setting ability in the domestic market of manufacturers from a foreign country whose costs in terms of the currency of the domestic manufacturer are linked to their country's inflation and domestic currency foreign currency exchange rates. Historical estimates of market power are estimated by a regression analysis with the restriction that the sum of all countries' market powers (including the domestic country) add up to one and that no country has a negative market power. Regression analysis is a procedure which seeks to measure the movement of a variable caused by movements or changes in another set of variables. For more detail see *Introduction To The Theory And Practice of Econometrics*. other models of market power can readily be incorporated in the analysis by those skilled in the art.

With aggregate markups, block 54, as a dependent variabl and with real xchange rates, block 58, as possible

independent variables, a restricted multiple regression is estimated on a computer using the following equation:

$$\alpha_t=\alpha_o+(1+\alpha_o)\sum_{k\neq H} a^k e_t^k$$

with the restriction that

$$a^k \geq 0, \text{ for all } k, \text{ and } \sum_{k\neq H} a^k \leq 1$$

where a^k is a measure of market power or price setting ability for firms in country k. Because a small non-zero value of market power could be purely due to chance, tests are performed, block 62, to determine if they are significantly different from zero in a statistical sense. Note the above equation can be run in a slightly modified form

$$\alpha_t-\alpha_o=(1-\alpha_o)\sum_{k\neq H} a^k e_t^k.$$

If no real exchange rate is statistically significant, as tested in block 64, foreign suppliers do not have any price setting ability in the local market in the context being analyzed. This implies that output prices in the domestic industry are fairly insulated from changes in real exchange rates. The industry is then examined as described in relation to Figure 6. If some real exchange rates are significant in this test, implying that foreign suppliers do influence prices and by implication their nominal exchange rates and their inflation rates influence prices in the domestic market, we proceed to an analysis of specific firms within the industry, block 66.

The second approach to evaluating the potential of an industry is discussed in Figure 6. Once again an industry is chosen, block 70. Price indices pertaining to that industry are collected, block 72. such indices are available from public sources for broad product categories or sometimes for specific products. For example, a broad paper price index or price indices for specific paper products,

such as, unbleached kraft paper, are available. Historical price indices for a product of an industry are labelled in where the subscript t is as defined previously and j denotes an item in the j-th product class.

Blocks 74 and 76 show the collection of data for past currency rates and the computation of past real exchange rates in a manner identical to that described in relation to blocks 56 and 58 in Figure 5. In block 78, regression of these indices against the real exchange rates are performed to check if any of the exchange rates, and implicitly the foreign competitors from that country, significantly affect prices. The sensitivity of price indices to real exchange rates is determined by running the following regression singly against all real exchange rates under consideration

$$\pi_t^j = Intercept + Slope\ (1+e_t^k)$$

or jointly against all real exchange rates

$$\pi_t^j = Intercept + \sum_{k=H} Slope_k\ (1+e_t^k)$$

and then testing for significance of the regression relationships, *i*.e. whether the slopes are significantly different from zero. The above testing procedure is robust to violations of standard assumptions in regressions.

The regression testing procedures used may be more sophisticated than an ordinary regression to take care of violations of assumptions that are implicit in ordinary regression. Such procedures may be understood by referring to *Introduction To The Theory And Practice Of Econometrics*. A determination is made whether the selected currencies have real exchange rates significantly different from zero, block 80. if no significant relationships exist, the industry is no longer considered under *Case I* as shown in block 82. Its potential for significance is then considered in *Cases II* and III. If a significant currency is found, as shown by block 84, then an analysis of specific firms in the industry

is mad . H wever, it must be noted that such an analysis of a firm may be made with ut first going through the industry analysis, especially after th concepts disclosed here become widely known.

2. Case II - Industry

A domestic manufacturing industry facing foreign competition was discussed in *Case I*. Now the situation of a manufacturer with costs of inputs affected by a foreign supplier is put into focus with the help of Figure 7. After choosing an industry, block 90, and after obtaining profit data, block 92, the past operating margins are computed, block 94. Aggregate past operating margins are expressed as

$$\beta = \frac{operating\ profit}{net\ sales}.$$

After obtaining currency rates and real exchange rates, blocks 96 and 98, just as described earlier for Figures 5 and 6, a multiple regression, block 100, is performed. With aggregate margins, block 94, as a dependent variable and with real exchange rates, block 98, as independent variables, a restricted multiple regression is performed to test the relationship

$$\beta_t=\beta_o-(1-\beta_o)\sum_{k\neq H} b^k e_t^k$$

with the restrictions

$$b^k \geq 0, \text{ for all } k, \text{ and } \sum_{k\neq H} b^k \leq 1$$

where b^k is a measure of market power or price setting ability for firms in country k. Note that this equation can be run in a slightly modified form

$$\beta_t-\beta_o=(1-\beta_o)\sum_{k\neq H} b^k e_t^k.$$

The derivation of this type of test is given earlier in the overview f the Math matics.

By d ing a r stricted regression analysis of the type d scribed in *Cas* I but with different parameters for market power, and using operating margin instead of operating markup, a check for price setting ability of foreign suppliers for the input items to the domestic manufacturer is accomplished. As a alternative, the *gross profit margin* may be used which is defined as gross profit (*i*.e. net sales less cost of goods sold) divided by net sales. This would exclude domestic marketing and general administration costs which are more likely to be linked to domestic inflation.

The regression analysis reveals the influence of changes in foreign exchange rates and foreign inflation on the costs of the domestic manufacturer. A test for significance of these market powers is again made, block 102. If significant foreign influence is found, the industry is marked for further analysis, after noting the currencies of interest, block 106. If these industries are found to have insignificant foreign influence under this test, block 104, the test given in Figure 8 is used.

Figure 8 illustrates the second approach to evaluating the extent of foreign influence on the costs of a manufacturer. once again an industry is chosen, block 110; cost indices pertaining to that industry are collected, block 112, and are designated

$$\chi_t^j$$

where the subscript t and j have been previously defined. Blocks 114 and 116 show the collection of data of past currency rates and the computation of past real exchange rates in a manner identical to that described earlier for blocks 56 and 58 in Figure 5.

The regression of these indices against the real exchange rates is performed, block 118, to check if any of the exchange rates significantly affect prices. The sensitivity of cost indices to real exchange rat s may be

determined, for example, by running th following regression singly against all real exchange rates

$$\chi_t^j = Intercept + Slope\ (1+e_t^k)$$

or jointly against all real exchange rates

$$\chi_t^j = Intercept + \sum_{k \in H} Slope_k\ (1+e_t^k)$$

and then testing for significance of the regression relationships, *i.e.* whether the slopes are significantly different from zero, block 120. The above testing procedure would be robust to violations of standard assumptions in regressions. The situation of no significant relationship is shown in block 122. If significance is found, further analysis is performed, block 124.

3. Case III - Industry

The third case considers an industry with operating profits predominantly tied to domestic inflation. Referring now to Figure 9, it can be seen that the approach is similar to the previous two cases. A relationship is sought between the operating profits of firms in the domestic industry and domestic inflation, or between price indices of output of the domestic industry and domestic inflation. operating profits may be adjusted for non-inflationary factors; for example when looking at the franchise food industry, operating profits may be adjusted to reflect changes in the number of outlets.

In more detail, an industry is chosen, block 130, and historical price indices for products produced by the industry are collected, block 132. These price indices are designated

$$\pi_t^j$$

where the subscripts t and j have previously been defined. A broadly defined price index for the product class could also have been chosen. Aggregate operating profits γ_t for

each period t are also computed. As b for , past cumulativ general inflati n indices for the domestic c untry ar collected, block 134. Then a regression of the price indices against the inflation rate is estimated, block 136, as follows:

$$\pi_t^j = Intercept + Slope\ I_t^H$$

and it is further tested for significance of the regression relationships, *i.e.* whether the slopes are significantly different from one. The sensitivity of aggregate operating profits to inflation may be checked by running the following regression

$$\gamma_t = Intercept + Slope\ I_t^H.$$

The above testing procedure will be robust to violations of standard assumptions in regressions. If no significant relationship exists under either regression, then the industry is no longer considered in this context, block 138. If a significant relationship does exist then the specific firms will be analyzed further, block 140, as explained below.

A variation on this case is an industry where operating costs are predominantly tied to domestic inflation. Referring to Figure 10, the analysis begins by choosing an industry, block 142, collecting and storing industry cost indices, block 144, collecting and storing past cumulative realized inflation indices, block 146 and running a regression of the cost indices on the inflation indices in block 148. if a significant relation exists, we proceed to a specific firm in the industry, block 152. No further analysis is indicated in this context if no significant relationship is found, block 150.

Attention is now directed away from an industry review and towards a firm review. It is possible for the system to start at this phase without having to go through the previous phase. Again three cases are used for

analysis. The first is a domestic manufacturer facing f r ign competiti n.

4. Case I - Firm

Figure 11 shows the technique for identifying firms within an industry that may benefit from managing their operating exposure. The analysis is very similar to that described in Figure 5. A firm is chosen, block 160; its operating profit data are collected in a computer, block 162; its past operating markup is computed, block 164; past currency rates are collected and stored, block 166; past real exchange rates are computed, block 168; and a restricted multiple regression is performed in block 170. After deriving the firm's exposure to different real exchange rates and the market power of competitors in different currencies, significance is determined, block 172, using tests explained before in relation to Figure 5. If no significance is found, the firm is no longer considered in this context, block 176. If significant currencies are found, there is a need to determine the amount of each currency that has to be hedged per unit of sales, block 174. The mathematics underlying the reasoning for this hedge amount is given in the Overview of the Mathematics, Section D above.

The following example is also provided for clarification to explain the situation for a simple, two country, two period case. Suppose there are two sellers of widgets in the U.S., one is a domestic manufacturer and the second is a Japanese manufacturer. Assume that they each have equal importance in the marketplace, so that each has a market power of 0.5. Let the price of a widget at the start of the period be $10. Let the domestic cost per widget be $5. Thus the operating markup is 1. Assume that the domestic manufacturer's costs go up identically with general inflati n in the U.S. In the absence of the Japanese

manufacturer, the American company would like to maintain a c nstant markup and also increase his pric s with general inflation in the U.S. The price of a widget at the start of the period in Japan is 1000¥ and assume that the exchange rate is 100¥ for a dollar at the start of the period. Also the Law of One Price holds at the beginning of the period.

Suppose, at the end of the period, the cumulative realized inflation rate in the U.S. was 20%, the nominal exchange rate was still 100¥ to a dollar and Japan had no inflation. The real exchange rate would have gone down to 0.833. This is found by multiplying one, which is the ratio of the nominal exchange at the start of the period divided by the nominal exchange rate at the end of the period, by 0.833, which is one plus the zero inflation rate in Japan divided by one plus the 0.2 inflation rate in the U.S.

The price of a widget in the U.S. would have gone up by 10%, if it is assumed that the market power of the domestic manufacturer is 0.5, and this is multiplied by 20% inflation, plus half the inflation rate in Japan (which happens to be zero in this case), since the Japanese manufacturer has a market power of 0.5. Thus the price of a widget in the U.S. would be $11, while the domestic manufacturer's cost would have gone up by 20% from $5 to $6. Hence his operating profit per widget would have remained at $5 but his operating markup would have dropped from 1 to 0.833.

The domestic widget manufacturer could have nullified this profit squeeze by entering into a financing arrangement disclosed here. There are two parts to this arrangement. The first part is that for each product unit that he planned to produce and sell during the period, he could have gone to Japan and borrowed 0.5 (the market power of the Japanese manufacturer) times 1000¥ (the Japanese price of a widget), discounted by the real Japanese interest rat . Assume th real Japan se interest rate was 10%. He

would thus have b rrowed 454.545¥ at the beginning of the period for each widget that he planned to pr duce during period 1.

The second part of the transaction would involve converting the amount he receives in the first part to dollars. Given the exchange rate, he would receive $4.545. He would invest it in a U.S. dollar Income Growth Security which pays him a real U.S. interest rate plus the actual inflation in the U.S. for that period. Assume that the real interest rate in the U.S. is also 10%, equal to the real rate in Japan.

At the end of the period, in the first part of the hedge, the U.S. firm repays 500¥, since Japan has had no inflation, and in the second part of the hedge, he receives 56 ($4,545 plus the real interest rate and the 20% actual inflation).

The net effect of this two-part financing/hedging arrangement is that for each product unit he realizes an additional dollar. If this is added to his realized profit of $5 per widget, he obtains a net profit of $6 per widget. Given that his costs are $6 per widget, his operating markup is 1. Thus, his markup has been constant and the profit squeeze which he would otherwise have suffered because of the presence of the Japanese competitor has been eliminated.

Returning now to Figure 10, the financing/hedging amount per product unit for each time period and for each significant currency is the firm's market power times the price of the product in the foreign country of the significant currency, discounted by the real rate of interest in that country, or

$$\frac{a^k p_o^k}{1+r_t^k}$$

where

$$p_o^k$$

is the price per unit in c untry k's currency at the start of the time peri d under c nsiderati n and

$$r_t^k$$

is the real interest rate from the start of the period under consideration to t, $t > 0$. In the widget example, the amount is 0.5 multiplied by 1000¥ divided by 1.1 because of a 10% real interest rate for a single time period.

Block 178 illustrates one part of the transaction, the total amount of borrowing in each significant currency. This is the sum over all time periods t, over the time horizon under consideration, of the hedging amount per product unit for each time period multiplied by the quantity of products expected to be sold for that time period ($\frac{a^k p_o^k}{1+r_t^k} q_t$ for every significant currency k and every period t), and pays back $(1+I_t^k) a^k p_o^k p_t$ at the end of each period t, $t > 0$, at the then prevailing exchange rate S_t^k. The number of product units expected to be produced in period t is represented by q_t. The time horizon would typically correspond to a strategic planning period, such as five, ten or twenty years. Block 178 also represents the structure of repayment at the end of each period for every significant currency k.

Block 180 illustrates the other part of the transaction, which is to convert the borrowed amounts into a home currency amount, at the current spot exchange rate and invest it in a domestic currency Income Growth Security at the domestic real interest plus cumulative realized domestic inflation rates. The maturity structure here matches the one specified for block 178. This may also be stated in the following way. convert the borrowed k currency loan to an equivalent amount in home currency at spot rate S_o^k; lend $\frac{a^k p_o^k}{(1+r_t^k) S_o^k} q_t$ to receive $\frac{a^k p_o^k (1+I_t^H)(1+r_t^H)}{(1+r_t^k) S_o^k} q_t$ at the end of every period t, $t > 0$, f r every significant currency. The

actual amount borrowed will b aggr gated across significant currencies and is not of any th r estimated borrowing needs f r working capital, long term investment, etc.

The investment in the domestic currency Income Growth Security would be net of the estimated domestic borrowing needs of the firm. These needs could arise due to an increase in working capital requirements, or a new project. In the widget example, the assumption is that the domestic manufacturer produces 100 units. If he has another project, say making ties, which requires an investment of $200, he might finance it by issuing Income Growth Securities for a year. Thus at the start of the period he borrows 45454.54¥ and converts the Yen amount to $454.54. Instead of now investing all the money in domestic currency Income Growth Securities, he may choose to invest $200 in his new project and invest only $254.54 in domestic currency Income Growth Securities.

As given in the Overview of the Mathematics and under the assumptions specified therein, the effect of this financing/hedging arrangement is to ensure a constant operating markup/margin.

5. Case II - Firm

Figure 12 sets forth the structure for estimating the exposure for the second case where a domestic firm has costs of inputs affected by foreign suppliers. The analysis is very similar to that described in Figure 7. A firm is chosen, block 190; its operating profit data is collected in a computer, block 192; its past operating margins are computed, block 194; past currency rates are collected and stored in a computer, block 196; past real exchange rates are computed in a computer, block 198; and a restricted multiple regression is performed, also by a computer, block 200. After estimating market power and determining significant currencies, block 202, a financing/hedging

strategy is f rmulated, blocks 204, 208 and 210. The case of no significant currency is represent d by block 206. The amount to be hedged for each product unit, for ach time period and for each significant currency is given as that currency's market power multiplied by the input cost per product unit and discounted by that currency/country's real interest rate for that period, or

$$\frac{b^k C_o^k}{1+r_t^k}$$

where

$$C_o^k$$

is the cost per product unit in country k's currency at the start of the time horizon and

$$r_t^k$$

is the real interest rate from the start of the period under consideration to period t, $t > 0$.

The mathematics for this is given in the Overview and another example is provided to better understand the materials disclosed herein. Suppose there is a souvenir manufacturer who packages two widgets in a box, embosses the box with the seal of New York State and sells it for $100, which is the price of the souvenir at the start of the period. For her the widget is an input and the souvenir is the product. Further suppose that she is the only one authorized to use the seal of New York State, which decrees that the price of the souvenir should be linked to the general U.S. inflation rate. Her input cost per unit product at the start of the period is $20, which is two times the price of a widget at the start of the period, which we know from the previous example was $10. Let the exchange rate at the start of the period be 100¥/$. Her operating profit is $80 and her operating margin is 0.8.

Suppose at the end of th period the actual inflation rate in the U.S. was zero and the cumulative realized inflation in Japan was 20%. In the previous example, this situation was reversed. Further the nominal exchange rate was still 100¥/$. Given that the market powers of the widget sellers were the same as in the previous example, by the reasoning given there, the price of a widget in the U.S. would have gone to $11. Thus her costs per unit product item would have gone to $22 because there are two widgets for each souvenir. But her souvenir price would have been fixed at $100. Thus her operating profit would have been reduced to $78, with a corresponding reduction in the operating margin to 0.78. She could have hedged against this adverse change by entering into a hedge which is the reverse of the type given in the first example.

There are also two parts to this hedge. The first is that for each product unit that she produced, she could have gone to Japan and lent 0.5 (the market power of the Japanese manufacturer) multiplied by two (the two widgets per souvenir), times the Japanese price of a widget, namely 1000¥, discounted by the real Japanese interest rates. Assume the real Japanese interest rate was 10%. Thus she would have lent 909.09¥ at the beginning of the period for each souvenir that she planned to sell during the first time period.

The second part of the transaction would involve financing the first transaction by borrowing in dollars. Given the exchange rate, she would have to borrow $9.09 per souvenir, through a U.S. dollar Income Growth Security, which pays a real U.S. interest rate plus the cumulative realized inflation in the U.S. Let us assume that the real interest rate in the U.S. is also 10%, which is the same as the real interest rate in Japan.

At the end of the period, in the first part of the hedge, as Japan has a 20% cumulative realized inflation

rate, she receives 1200¥ or $12 at the end of the peri d. In the sec nd part of the hedge, she pays $10, $9.09 plus the real interest rate of lot. The net effect of the financing/hedging arrangement is that for each product unit she realizes an additional two dollars. If we add this to her realized profit, $78 per souvenir, she obtains a net profit of $80 per souvenir. Her margin has remained constant and the profit squeeze to which she would otherwise have been exposed because of the change in the real U.S. dollar/yen exchange rate has been eliminated.

There is a flip side to this hedge, which is inherent in any hedging transaction. Namely, if as in the first example, Japan had no cumulative realized inflation and the U.S. had 20% cumulative realized inflation, she would have realized a profit of $98, had she not entered into the hedge. With the hedge, she would still receive $96, maintaining her operating margin of 0.8.

Returning to Figure 12, the two parts of the financing/hedging strategy are given in blocks 208 and 210. it is in effect, the reverse of the transaction in the first case. The total amount lent/invested in each significant currency, block 208, is the sum over all time periods for the time horizon under consideration of the hedging amount per product unit (as determined in block 204) for each time period multiplied by the quality of products expected to be sold for that time period. Expressed in another way, the firm arranges to lend

$$\frac{b^k C_o^k}{1+r_t^k} qt$$

for every significant currency k and for every period t and to receive

$$(1+I_t^k) b^k C_o^K q_t$$

the end of each period t, $t > 0$, at the then prevailing exchange rat

S_t^k.

Th number of pr duct units expected to be produced in period t is expressed as q_t. In the souvenir example, the amount lent was 909.09¥.

Block 210 gives the other part of the transaction, which is to finance the loaned amounts by borrowing an equivalent amount in the home currency at the prevailing spot exchange rate by issuing local currency Income Growth Securities whose maturity structure matches the one specified in block 208. Expressed in a different way, the firm would finance each currency loan by borrowing an equivalent amount in its home currency at a spot rate S_o^k. The firm borrows

$$\frac{b^k C_o^k}{(1+r_t^k) S_o^k} q_t$$

and pays back

$$\frac{b^k C_o^k (1+I_t^H)(1+r_t^H)}{(1+r_t^k) S_o^k} q_t$$

at the end of every period t, for every significant currency, $t > 0$. The actual amount lent will be aggregated across significant currencies and would be net of any other estimated borrowing needs, such as for working capital or long term investment.

6. Case III - Firm

The third case is of a domestic manufacturer with operating profits predominantly tied to domestic inflation. Figure 13 illustrates the details of this case. The analysis begins with the choice of a firm, block 220, the collection of the firm's profit data, block 222, and the collection of cumulative realized general inflation data, block 224. The historical operating profit data is designated γ. By running a regression, block 226, it can be determined if a domestic firm's operating profits are

significantly link d to domestic inflation. Th regression is $\gamma_t = Intercept + Slope\ I_t^H$ and is tested to determine whether the slope is significantly different from one. The above testing procedure would be robust to violations of standard assumptions in regressions. If there is a significant relationship, then to maintain a more stable operating markup, it is better for the firm to have its interest payments linked to cumulative realized inflation by issuing domestic currency Income Growth Securities. Thus its debt service (repayments of principal and interest) will closely match the pattern of its revenues. After the borrowing needs are estimated, block 230, the repayment streams under the structure disclosed enable the maintenance of a constant operating markup. The following amount will be borrowed

$$\frac{A}{(1+r_t^H)}$$

and the firm will promise to pay back

$$a(1+I_t^H)$$

where

$$r_t^H$$

denotes real interest rate from the start of the time period to time t, $t > 0$, such that the total of borrowing across the time periods will be equal to the estimated borrowing needs of the firm. The case of no significant relationship is represented by block 228.

A variation on this case is that of a domestic manufacturer with costs predominantly tied to domestic inflation. The analysis includes choosing a firm, block 232, Figure 14, collecting and storing a firm's cost data, block 234, collecting and storing cumulative realized general inflation indices, block 236, and performing a regression of the cost on general inflation, block 238. No significant relationship is repr sented by block 240 while

significantly linked t domestic inflation. The regression is $\gamma_t = Intercept + Slope\ I_t^H$ and is tested to d termine whether the slope is significantly different from one. The above testing procedure would be robust to violations of standard assumptions in regressions. If there is a significant relationship, then to maintain a more stable operating markup, it is better for the firm to have its interest payments linked to cumulative realized inflation by issuing domestic currency Income Growth Securities. Thus its debt service (repayments of principal and interest) will closely match the pattern of its revenues. After the borrowing needs are estimated, block 230, the repayment streams under the structure disclosed enable the maintenance of a constant operating markup. The following amount will be borrowed

$$\frac{A}{(1+r_t^H)}$$

and the firm will promise to pay back

$$a(1+I_t^H)$$

where

$$r_t^H$$

denotes real interest rate from the start of the time period to time t, $t > 0$, such that the total of borrowing across the time periods will be equal to the estimated borrowing needs of the firm. The case of no significant relationship is represented by block 228.

A variation on this case is that of a domestic manufacturer with costs predominantly tied to domestic inflation. The analysis includes choosing a firm, block 232, Figure 14, collecting and storing a firm's cost data, block 234, collecting and storing cumulative realized general inflation indices, block 236, and performing a regression of the cost on general inflation, block 238. No significant relationship is represented by block 240 while

the borrowing analysis as just discuss d is represented by block 242.

G. Performance Simulations

Figure 15 illustrates an overview of the system for running performance simulations. First is the collection and storage on a computer of historical financial data including exchange rates, inflation rates and nominal interest rates, block 250. With this information, a joint stochastic process is established for exchange rates, inflation rates and nominal interest rates, block 252. Next initial values of the stochastic process from the current data or analysis of historical data are established and these are set at $t=0$, block 254. Thereafter, for a time period t, $t > 0$, exchange rates, inflation rates and nominal interest rates are generated, block 256, based on the stochastic process established, block 252 and the values at $t=0$ of these same variables set forth, block 254. At the same time possible finance/hedging structures of the firm along with its estimated sales volume, input quantities and capital costs are identified, block 258, for all periods in the time horizon under consideration.

Also as shown in block 260, initial balance sheet values are established from current data and this is used as the setting for $t=0$. Thereafter, a product-wise and geographic market-wise simulation is performed, block 262. This includes computing the price per product prevailing in the market based on the market power of different currencies obtained from block 258 and the simulated inflation rates obtained from block 256. From this, net sales, costs and operating profits are computed. Similarly, debt service costs based on the respective financing structures being considered are computed. Thereafter operating markups and margins and aggregate results for the firm are computed. Then profit and loss accounts and updated balance sheet

items are prepared. This is repeat d for all periods on the time horiz n.

Thereafter as shown by block 264, from the simulated operating margins/markups, net sales, cost of goods and debt service payments are computed. Similarly, the variances and other measures of the distribution of likely outcomes for each desired measure of performance are computed.

Except for the disclosures related to blocks 252 and 254, the information related to the other blocks involve standard accounting procedures (see *Financial Statement Analysis)*. Block 252 requires statistical approaches to model the inflation, exchange rate and interest rate processes. See S.M. Ross, *Stochastic Processes,* (John Wiley & Sons 1983) and *Introduction To Statistical Time Series* (John Wiley & Sons 1983). This modelling involves specification of an underlying process and the estimation of parameters of the underlying process. For example, one specification of the real exchange rate could be a mean reverting process. By this it is meant that the real exchange rate follows a process which tends in the long run to move towards a value of one, but which could temporarily deviate from the long run movement towards one. These temporary deviations can be modeled to be of a particular size and could be made independent of each other, such that a large positive temporary deviation today says nothing about the size or sign of a deviation tomorrow. The parameters to be estimated in the above process are the sizes of the deviations and the speed of the long term move towards one.

Specification of the real interest rate process could be a square root process. See J. C. Cox, et al., A *Theory Of The Term Structures Of Interest Rate,* Econometrics 53, pp. 385407 (March, 1985). Specification of the inflation rates process can be an autoregressive process

where this period's inflation is a fraction of last period's inflation plus a temporary deviation which is independent of previous temporary deviations. Given the model in block 252, the actual values are simulated, block 254 by a Monte Carlo simulation (see s.M. Ross, *Stochastic Processes,* John Wiley & Sons 1983).

Figures 16, 17 and 18 show simulations involved in developing the actual financing/hedging recommendations to firms for the three cases mentioned before. The difference between the analysis in this phase and that of the earlier phase for identifying a firm (Figures 11, 12 and 13), is primarily in the quality of input data used in terms of both the accounting and financial data and the estimate of borrowing needs of the firm, as well as in the clarity in specification of the firm's objectives, in terms of desired stability in operating markups, and the firm's financing constraints. It should be pointed out that an analysis for a particular firm can start at this phase, or even later, without going through the earlier phases.

1. Case I - Simulation

Figure 16 illustrates a detailed analysis of a domestic manufacturer facing foreign competition. First, a firm is selected, block 270. Thereafter, as illustrated by block 272, there is the collection of product-wise historical operating profit data and net sales data on an annual or quarterly basis which may be obtained from sources internal to the firm. This data will be more precise than data used in Figures 5 and 11.

Product-wise operating markups are computed, block 274 and past currency rates are collected, block 276. Thereafter, regressions are completed, block 278, of the type performed in relation to block 170, Figure 11. The above analysis may be done product-wise, block 280, for each future period of the time horizon.

In bl ck 282 and 284 a determination of the hedge am unt is made as was done in r lation t blocks 178 and 180. Thereafter, as shown in block 286, the analysis requires a review of capital and budgeting plans of the firm to determine currency-wise borrowing needs. Other information, such as corporate objectives and/or financing constraints, associated for example, by credit considerations, may limit the financing to only a fraction of the amount determined, blocks 282 and 284. The actual amounts borrowed may be the amounts computed according to block 282, adjusted for the partial extent that the corporation wants to be hedged and net of other borrowing needs as determined, block 286. Thereafter a simulation is performed to generate the results in block 290. Corporate preferences for stability of earnings and other measures of performance are obtained and the simulation results are matched with these preferences, block 292. All of this may cause an adjustment in the borrowing needs, block 288.

Revisiting an earlier example, the domestic widget manufacturer's banks may have said that based on the state of its balance sheet, it can only borrow a maximum of $100 or its equivalent in any currency. Then the widget manufacturer, who needs to borrow 45454.54¥, having a dollar equivalent of $454.54 will be able to borrow only 10000¥. This is an example of the financing constraints referred to, block 288, which limit the extent of financing.

For another example, the widget manufacturer may decide that it does not mind bearing a certain degree of fluctuation in its operating markup. Based on its preferences the manufacturer may decide to only hedge 80% of its exposure even though there are no binding borrowing restrictions imposed by any financial institution. Thus, instead of borrowing 45454.54¥, it may only borrow 36363.63¥ and invest $363.63. Hence, a clearer specification of the c rporate bjectives, block 292, enables the adjustment of

the financing structure t match individual c rporate risk preferenc s and/or financing c nstraints.

2. Case II - Simulation

Referring now to Figure 17, there is shown the actual analysis and recommendations to a manufacturer who has costs of input affected by foreign suppliers. The analysis begins by the identification of a firm, block 300. We collect product wise historical operating profit data and net sales data on an annual or quarterly basis, block 302. This data may incorporate internal records of the firm and have more accurate information than in block 192 or 92. Block 304 represents the computation of product-wise past operating margins. Blocks 306 through 314 are equivalent to blocks 196 through 208 (excepting block 206). However, the analysis may be done at the level of the product line.

Block 316 represents a review of the firm's borrowing needs after taking into account its capital and budgeting plans. Block 318 represents the adjustments that may be made once the firm's objectives and/or financing constraints are considered. Thereafter, as represented by block 320, the results are simulated and as represented by block 324, firm preferences concerning the stability of earnings and other measures of performance are considered. Finally, the simulation results are matched with firm preferences, block 324.

The point made about the first case, Figure 16, concerning the availability of better data and clarity in firm objectives and/or financing constraints is still valid. Blocks 318, 320 and 324 represent information used to adjust the financing requirements to the firm's preferences.

3. Case III - Simulation

Figure 18 shows the actual analysis and recommendations in the case of a domestic manufacturer with

perating pr fits or other measures of performance related at least in part to domestic inflation. Block 326 identifies the ch ice of the firms to be analyzed. Block 328 denotes a collection of product-wise historical operating profit data represented by γ.

The activity represented by blocks 330 through 336 is similar to the activity, disclosed in blocks 224, 226 and 230. Thereafter the results are simulated, block 338, and firm preferences are incorporated, block 340.

Figure 18 is analogous to Figure 13 and the considerations discussed in case I and Case II are also valid here.

The analysis of a domestic manufacturer with costs related at least in part to domestic inflation is shown in Figure 19 where the system and method includes the identification of a firm, block 350, the collection and storage of a firm's cost data, block 352, the collection and storage of cumulative realized general inflation indices, block 354, and the computation of a regression of cost on general inflation, block 356. Thereafter a determination of the additional borrowing needs is made, block 350, followed by the determination of the amount to be borrowed in Income Growth Securities, block 360. Simulations are performed, block 362, and the firm's preferences are incorporated, block 364.

H. Analysis for Investors

1. Pension Plans

Although the number of natural investors in Income Growth Securities is very large, it is convenient to identify three broad classes by way of example. First are investors whose investment in a portfolio of assets today is intended to fund future obligations which are expected to increase with cumulative realized inflation, among other factors. Investors who fall in this class, for example, are

defined benefit pension plans which have an bligation to fund the future active lives liabilities associated with current employees and insurance companies which face deferred claims.

Traditionally, pension plans have used a forecast of inflation to estimate the value of the future active lives liability. This liability is then assumed known for the purpose of asset selection and the pension plan manager can select fixed income securities, such as bonds, to fund some portion of this known future liability. If the future liability is in fact known with certainty, these bonds will be riskless in the sense that they will exactly fund the future liability. However, the estimation of the future liability involves an assumption on the value of future cumulative inflation. If the assumption of future inflation turns out to be incorrect, which will generally be the case over an extended time horizon, the bonds may not have funded the liability when it becomes due.

A new way of defining the future liabilities of the plan is needed which avoids the need to make an assumption on the value of cumulative future inflation over the time horizon for which the assets are being managed. If attention is first focused on the active lives liabilities associated with employees who will be retiring in some future year, say in ten years time, an analysis will proceed as follows. We can estimate the future pension plan liability by multiplying the number of employees retiring in ten years by their current earnings and by a cumulative inflation rate, which corresponds to the increase in their earnings during the next ten years and by a multiplier which takes into account: (1) the fraction of final earnings used to calculate the annual pension; and (2) the number of years for which the employee will collect the pension.

There are two kinds of terms in this estimate of the future pension plan liability. The estimate of the

cumulative inflation rate is uncertain and involves factors which are external to the firm. All the ther terms are essentially different in that they involve factors internal to the firm, which can be estimated with relative accuracy. We can therefore combine all the terms other than the inflation factor into a term which we can call the *future pension plan liability in today's dollars,* block 390 of Figure 21. This would be the future pension plan liability if there were no increase in wages. We can fund the full future liability in future dollars if we have a security whose return matches the increase in the liability over time due to cumulative inflation. Estimating inflation in the future to project the future value of the liability in future dollars is not necessary. Instead, the *future liability in today's dollars,* before the effects of inflation, is estimated and then investment in a security which will increase with cumulative inflation over time is contemplated.

Such a security is an individual tranche of a finite type Income Growth Security, whose principal at maturity is indexed to cumulative realized inflation over the time period, ten years in our example. In the more general case, where the continuing active lives liabilities of the plan over many years are taken into account, the plan would invest in finite type Income Growth Securities or perpetual type Income Growth Securities, which have the desired repayment structure over the corresponding time period. An investment in the Income Growth Security will increase in value in two steps. Firstly, it will increase by the amount of a real interest rate, three percent per year for example, which is determined at the time of making the initial investment. Secondly, it will increase by the amount of cumulative inflation that is realized over the period.

An analysis of this future liability is graphically depicted in Figure 20 and is made up of several parts. The first block 370 calculates the future liability to current employees if the plan were terminated today. The second block 372 calculates the increase in the future liability because of changes in actuarial assumptions internal to the firm but before considering any wage inflation. Included in this part would be an increase in the number of vested employees expected to retire in the future year because of new hires in the next few years and an increase in the number of years of service used to calculate the pension formula as a fraction of final salary. The sum of the values calculated in blocks 370 and 372 is *the future liability in today's dollars* which we have previously described. In the third block 374, we calculate the increase in the future liability because of cumulative realized wage inflation. The sum of the values in blocks 370, 372 and 374 is the future value of the liabilities in future dollars.

The liability may now be compared with the matching asset. In block 376, we determine the amount of the investment required to fund the future liability in future dollars *as the future liability in today's dollars* discounted at the real interest rate. This investment today in an Income Growth Security, block 376, will increase due to a real return, block 378, and will also increase due to cumulative realized general inflation, block 380. The future value of this investment in future dollars, which is the sum of the values computed in blocks 376, 378 and 380 will match the future liability in future dollars, which is the sum of the values computed in blocks 370, 372 and 374 if wage inflation closely follows general inflation. In Figure 28, we perform a regression, block 448,m of cumulative realized wage inflation, block 446, on cumulative realized general inflation, block 444. If the relationship is

acceptably close, block 450, then the uncertainty in the future returns on the Income Growth Security closely match the uncertainty in the future value of the active lives liability. In this case, although the Income Growth Security has an uncertain future return in nominal terms, because inflation is unknown before the fact, it is a riskless security in the sense of funding with certainty the portion of the future liability which increases with cumulative realized inflation. However, if we find that the relationship between wage inflation and a general measure of inflation is not acceptable, block 452, the Income Growth Security will not be a useful riskless security in funding the active lives liability. Figure 27 shows that in the U.S., cumulative realized wage inflation has historically closely matched cumulative realized general inflation.

In general, a plan will calculate its total assets, block 391 of Figure 21, as shown previously, block 376 of Figure 20. The plan will invest a part in Income Growth Securities, block 392, and the remainder in risky assets, block 394, in an effort to increase returns. Examples of such risky assets are stocks or real estate. The risk preference of the plan's sponsors is considered, block 396, to determine the fraction of the plan's assets to be invested in risky assets. This determination may involve the use of simulations of the type previously discussed in Section G. When it is recognized that the objective of the plan should be to optimize the ability of the portfolio to fund future liabilities which increase with cumulative inflation, a model of asset allocation, block 398, selects a mix of assets, block 400, using standard portfolio theory, with the exception that inputs are the expected real returns on each asset class and the covariances between real returns on each asset class, block 402. These are different inputs than the inputs traditionally used to choose the mix of asset classes which optimize the ability of the portfolio to

fund future liabilities which are considered known, because futur inflation has been s parately stimated. In the traditi nal cas , the inputs are the expect d n minal returns on each asset class and the covariances between nominal returns on each asset class. Accordingly, the mix of asset classes in the portfolio will be different from the traditional mix when the plan's sponsor recognizes that future liabilities are inflation dependent.

2. Retirement Plans

A second broad class of potential investors is investors who want to be assured of increasing the purchasing power of their investment rather than seeking to increase the nominal value of their investment, independently of its ability to purchase goods and services. It may be argued that money only has value in terms of its ability to purchase goods or services so that this is a rational objective for a conservative investor. Unlike the previous case, these investors may not have contractually defined future obligations.

Individual investors who are saving for their retirement years may therefore invest in a finite type Income Growth Security. The Income Growth Security would be chosen to have a first payment on the expected retirement date of the investor and the final payment date would be chosen to exceed his expected lifetime. Depending on his risk preferences, the investor may again choose to invest part of his assets in risky securities as was discussed in the case of a pension plan. The mix of the portfolio will again be determined by the real return characteristics of each asset class.

The similarity of this example with the previous example can be further explored. In the case of the pension plan, the amount to be invested is computed starting from the estimate of the future liabilities. In the case of the

individual investor, the amount to be invested may either be ex gen usly determined or it may be partially determined by_the investor, block 410 of Figure 22, as the amount f savings that has to be set aside to fund expected future living needs. The required savings may most accurately be defined as the expected future living needs in today's dollars, discounted at the real interest rate. In this latter case, it is income and expenses that are adjusted by the investor to make available the amount of savings required to fund future needs. In this respect the behavior of the investor is similar to that of the pension plan. In both investor cases, however, the investment behavior is the same, so that the calculations made in relation to blocks 412-422 are the same as the calculations made in relation to their counterpart blocks 396-402 of Figure 21.

3. Endowments

Another class of possible investors in Income Growth Securities are endowments or trusts, who have a known amount of money today and want to be able to maintain their ability to support worthy causes in the future at the same level in real terms. By purchasing a perpetual Income Growth Security, the endowment would receive an amount each year forever which preserves its purchasing power so that the endowment has purchased a perpetuity in real terms. Alternatively, the endowment might invest its assets in finite type Income Growth Securities to annuitize its assets *in real terms*, i.e. if the endowment desires to use the value of its assets today to be able to fund worthy causes at a constant level of purchasing power over a finite time span in the future.

In this endowment case, the amount of money to be invested may again either be exogenously determined, block 430, of Figure 23 or computed by discounting at the real interest rate the futur distributions in today's dollars

which the endowment wishes to mak in th future. This is similar t the calculati n, block 410, of the previous cas . In this latter cas , there would then b an attempt to collect the endowment which would make this future level of distributions possible.

If the endowment chooses to invest part of its wealth in risky assets, the asset mix of the portfolio will be determined by the real return characteristics of each asset class. The allocation of the endowment between Income Growth Securities, block 434 and risky assets, block 436, is based on the risk preferences of the endowment, block 432, and the selection of the mix of risky assets, block 438, which in turn is based on a model of asset allocation, block 440 using as inputs the real return characteristics of each asset glass estimated, block 442. These are all closely similar to the disclosures related to blocks 392-402 and 412-422 of the previous two cases.

I. Conclusion

The full structural systems and methods have now been disclosed. It can be appreciated that data processing is necessary to efficiently and effectively operate many aspects of the systems and methods and it is therefore integrally included. While preferred embodiments have been disclosed in full, clear, concise and exact terms, it is understood that the science of finance and investing will continually advance so that variations and modifications will occur; however, these will not be outside of the invention herein as long as they come within the claims appended hereto.

It should be understood and emphasized that the inventive systems and methods satisfy the unrelated needs of issuers and investors by issuing and investing in, respectively, Income Growth Securities. Thus what is disclosed is a natural arrangement in which both sides of a

financial operation are satisfied. The imp rtance f this becomes apparent when we appreciate that there have been several references to the needs by pension plans of real interest securities but that these needs have not been met because of a lack of natural issuers. This in part has been due to an emphasis on structures of real interest rates securities which have not met the needs of both issuers and investors. In particular, issuers have not been identified because a multiperiod Income Growth Security did not exist and it is such a security that is desirable to match financing costs with the earnings ability of long-lived assets which are to be financed. The disclosure herein identifies systems and methods embodying these securities that address the realistic economic needs of both issuers and investors and without any constraints of existing security structures.

WHAT IS CLAIMED:

1. A method for providing an impr ved financing and investing system comprising the steps of:

a. determining, including assisting in the determination, that an entity has, including the contemplation of having, an asset with a multiyear life where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country;

b. issuing, including assisting in the issuance of, an Income Growth Security to at least partially fund said asset in the currency of said country;

c. determining, including assisting in the determination, that another entity has a desire to fund a future liability which liability is expected to increase at least in part with inflation in said country when measured in the currency of said country; and

d. investing, including assisting in investing in an Income Growth Security in said currency to at least partially fund said future liability.

2. A method for providing an improved financing and investing system comprising the steps of:

a. determining, including assisting in the determination, that an entity has, including the contemplation of having, an asset with a multiyear life where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country;

b. issuing, including assisting in the issuance f an Income Growth Security to at least partially fund said asset in the currency of said country;

c. determining, including assisting in the determination, that another entity has a desire to annuitize the value of its assets in real terms in said country when measured in the currency of said country over a period of time; and

d. investing, including assisting in investing, in an Income Growth Security in said currency to at least partially fund said annuity.

3. A method as claimed in Claim 1 or 2 in which the Income Growth Security has a multi-period repayment structure which repayment structure is a function of cumulative realized inflation.

4. A method as claimed in Claim 3 wherein said multiperiod repayment structure is infinite in length.

5. A method as claimed in Claim 1 or 2 in which the repayment structure of the Income Growth Security follows the expression:

$D\ (1 + I_T)$ at the end of T periods,

$D\ (1 + I_{T+1})$ at the end of T+1 periods,

$D\ (1 + I_{T+2})$ at the end of T+2 periods,

$D\ (1 + I_{T+N})$ at the end of T+N periods,

where D is a constant amount of money; I is cumulative realized inflation, expressed as a fraction, from the effective start of the transaction for which the security was issued; the first payment is made at the end of T periods; and payments are made at the end of every period thereafter to the final payment of the transaction at T+N, where N may be finite or infinite.

6. A method as claimed in Claim 1 or 2 in which the repayment structure of the Income Growth Security

follows the expression:

$D\ (1 + I_{T-d})$ at the end of T periods,

$D\ (1 + I_{T+1-d})$ at the end of $T+1$ periods,

$D\ (1 + I_{T+2-d})$ at the end of $T+2$ periods,

$D\ (1 + I_{T+N-d})$ at the end of $T+N$ periods,

where D is a constant amount of money; I is cumulative realized inflation expressed as a fraction from the end of d periods before the effective start of the transaction for which the security was issued to the end of $T-d$ periods for the payment made at the end of T periods; the first payment is made at the end of T periods; and payments are made at the end of every period thereafter to the final payment of the transaction at $T+N$, where N may be finite or infinite.

7. An improved financing and investing system comprising:

a. an entity having an asset, including the contemplation of having said asset, where said asset has a multi-year life and where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country;

b. an Income Growth Security issued by said entity to at least partially fund said asset in the currency of said country;

c. another entity having a desire to fund a future liability which liability is expected to increase at least in part with inflation in said country when measured in the currency of said country; and

d. wherein said other entity invests in said Income Growth Security to at least partially fund said future liability.

8. An improved financing and investing system comprising:

a. an entity having an asset, including the contemplation of having said asset, wherein said asset has a multi-year life and where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country;

b. an Income Growth Security issued by said entity to at least partially fund said asset in the currency of said country;

c. another entity having a desire to annuitize the value of its assets in real terms in said country when measured in the currency of said country over a period of time; and

d. wherein said other entity invests in said Income Growth Security to at least partially fund said annuity.

9. A system as claimed in Claim 7 or 8 in which the Income Growth Security has a multi-period repayment structure which repayment structure is a function of cumulative realized inflation.

10. A system as claimed in Claim 9 wherein said multiperiod repayment structure is finite in length.

11. A system as claimed in Claim 7 or 8 in which the repayment structure of the Income Growth Security follows the expression:

$D\ (1 + I_T)$ at the end of T periods,

$D\ (1 + I_{T+1})$ at the end of T+1 periods,

$D\ (1 + I_{T+2})$ at the end of T+2 periods,

$D\ (1 + I_{T+N})$ at the end of T+N periods,

where D is a constant amount of money; I is cumulative realized inflation, expressed as a fraction, from the

effectiv start f the transaction for which the s curity was issued; the first payment is mad at the end of T periods, and payments are made at the end of every period thereafter to the final payment of the transaction at $T+N$, where *N may be finite or infinite.*

12. A system as claimed in Claim 7 or 8 in which the repayment structure of the Income Growth Security follows the expression:

$D\ (1 + I_{T-d})$ at the end of T periods,

$D\ (1 + I_{T+1-d})$ at the end of $T+1$ periods,

$D\ (1 + I_{T+2-d})$ at the end of $T+2$ periods,

$D\ (1 + I_{T+N-d})$ at the end of $T+N$ periods,

where D is a constant amount of money; I is cumulative realized inflation, expressed as a fraction, from the end of d periods before the effective start of the transaction for which the security was issued to the end of $T-d$ periods for the payment made at the end of T periods; the first payment is made at the end of T periods; and payments are made at the end of every period thereafter to the final payment of the transaction at $T+N$, where N may be finite or infinite.

13. A method for providing an improved financing system comprising the steps of:

a. determining, including assisting in the determination, that an entity has, including the contemplation of having, an asset with a multiyear life where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country; and

b. issuing, including assisting in the issuance of, an Income Growth Security in the currency of said country to at least partially fund said asset.

14. A method as claimed in Claim 13 wherein said measure of performance is revenues.

15. A method as claimed in claim 13 wherein said measure of performance is cash flow.

16. A method as claimed in Claim 13 wherein said asset is a merged or acquired entity.

17. A method as claimed in Claim 16 wherein said measure of performance are revenues.

18. A method as claimed in Claim 16 wherein said measure of performance is cash flow.

19. A method as claimed in Claim 13 wherein said asset is a physical asset, such as a manufacturing plant.

20. A method as claimed in Claim 19 wherein said measure of performance are revenues.

21. A method as claimed in Claim 19 wherein said measure of performance is cash flow.

22. A method as claimed in Claim 13 wherein said asset is real estate.

23. A method as claimed in Claim 22 wherein said measure of performance are revenues.

24. A method as claimed in Claim 22 wherein said measure of performance is cash flow.

25. A method as claimed in Claim 13 wherein said entity has at least one foreign competitor and the issuing step comprises issuing the Income Growth Security in the currency of the country of production of said foreign competitor.

26. A method as claimed in Claim 13 wherein said entity has at least one foreign competitor and the issuing step comprises issuing the Income Growth Security in the currency in which the entity has been determined to be exposed.

27. A method as claimed in Claim 13 wherein said entity has a plurality of foreign competitors and the issuing step comprises issuing Income Growth Securities in

the respective currencies of the countries of production of said foreign competitors.

28. A method as claimed in Claim 13 wherein said entity has a plurality of foreign competitors and the issuing step comprises issuing Income Growth Securities in the various currencies in which the entity has been determined to be exposed.

29. A method for providing an improved financing system comprising the steps of:

a. determining that an entity has an asset with a multi-year life where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country; and

b. issuing an Income Growth Security in the currency of said country to at least partially fund said asset.

30. A method for providing an improved financing system comprising the steps of:

a. assisting in the determination that an entity has an asset with a multi-year life where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country; and

b. assisting in the issuance of an Income Growth Security in the currency of said country to at least partially fund said asset.

31. A method for providing an improved financing structure comprising the steps of:

a. assisting in the determination that an entity is contemplating having an asset with a multi-year life where some measure of the

performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country; and

b. assisting in the issuance of an Income Growth security in the currency of said country to at least partially fund said asset.

32. An improved financing system comprising:

a. an entity having an asset, including the contemplation of having said asset, with a multiyear life where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country; and

b. an Income Growth Security issued by said entity in the currency of said country to at least partially fund said asset.

33. An improved financing system comprising:

a. an entity which contemplates having an asset with a multi-year life where some measure of the performance of said asset, such as cash flow, is expected to increase at least in part with inflation in a country when measured in the currency of said country; and

b. an Income Growth Security issued by said entity in the currency of said country to at least partially fund said asset.

34. A system as claimed in Claim 32 or 33 wherein said measure of performance is revenues.

35. A system as claimed in claim 32 or 33 wherein said measure of performance is cash flow.

36. A system as claimed in Claim 32 or 33 wherein said asset is a merged or acquired entity.

37. A system as claimed in Claim 36 wherein said measure of performance is r venu s.

38. A system as claimed in Claim 36 wherein said measure of performance is cash flow.

39. A system as claimed in Claim 32 or 33 wherein said asset is a physical asset, such as a manufacturing plant.

40. A system as claimed in claim 39 wherein said measure of performance are revenues.

41. A system as claimed in Claim 39 wherein said measure of performance is cash flow.

42. A system as claimed in Claim 32 or 33 wherein said asset is real estate.

43. A system as claimed in Claim 42 wherein said measure of performance are revenues.

44. A system as claimed in Claim 42 wherein said measure of performance is cash flow.

45. A system as claimed in Claim 32 or 33 wherein said entity has at least one foreign competitor and wherein said Income Growth Security is issued in the currency of the country of production of one such foreign competitor.

46. A system as claimed in Claim 32 or 33 wherein said entity has at least one foreign competitor and wherein said Income Growth Security is issued in a currency in which the entity has been determined to be exposed.

47. A system as claimed in Claim 32 or 33 wherein said entity has a plurality of foreign competitors and wherein said Income Growth Securities are issued in the respective currencies of the countries of production of said foreign competitors.

48. A system as claimed in Claim 32 or 33 wherein said entity has a plurality of foreign competitors and wherein Income Growth Securities are issued in the various currencies in which the entity has been determined to be exposed.

49. A method for providing an improved financing system for the borrowing needs of an entity comprising the steps of:

a. collecting selected historical performance data relating to said entity;

b. collecting selected financial data of selected country or countries;

c. computing a regression of said entity's performance data on said financial data of said country or countries;

d. determining significance of the statistical relationship between said entity's performance data and the financial data of said country or countries;

e. determining a potential hedge amount; and

f. determining an amount of financing using Income Growth Securities.

50. A method as claimed in Claim 49 including the step of converting the amount of financing to the currency of the country in which the funds are required.

51. A method as claimed in Claim 49 including the steps of:

a. determining additional financing needs;

b. determining the capacity of said entity to borrow; and

c. adjusting said financing needs.

52. A method as claimed in Claim 49 including the steps of:

a. generating performance simulations; and

b. considering risk preferences of said entity.

53. A method as claimed in Claim 49 including the steps of:

a. converting the financing amount to the currency of the country in which the funds are needed;

b. determining additional financing needs; and

c. adjusting said financing n eds.

54. A method as claim d in Claim 49 including the steps of borrowing using Income Growth Securities in one currency and investing at least a portion of the proceeds in Income Growth Securities in another currency.

55. A method as claimed in Claim 49 in which:

a. the said financial data of said country or countries are inflation data; and

b. if a correlation is shown to exist between said performance data and said inflation data of a country, including the step of issuing Income Growth Securities paying an interest rate which is a function of the realized inflation rate of the country for which said correlation exists.

56. A method as claimed in Claim 49 wherein the performance data are calculated without a fixed cost component.

57. A method as claimed in Claim 49 wherein the performance data is a measure of performance.

58. A method as claimed in Claim 57 wherein the measure of performance is calculated as revenues minus costs divided by costs.

59. A method as claimed in Claim 57 wherein the measure of performance is calculated as revenues minus costs divided by revenues.

60. A method as claimed in Claim 57 wherein the measure of performance is revenues.

61. A method as claimed in Claim 49 including the step of limiting the scope of the entity to be considered in collecting historical performance data.

62. A method as claimed in Claim 49 including the steps of testing said historical performance data for

seasonality; and if seasonality is present, altering said historical perf rmanc data to yi ld deseasonalized data.

63. A meth d as claimed in Claim 49 wherein the financial data are real exchange rates between two selected countries, one country being the country whose cumulative realized inflation will determine the characteristics of the Income Growth Security.

64. A method as claimed in Claim 49 wherein the financial data are cumulative realized inflation rates of said selected countries.

65. A method as claimed in Claim 49 including the step of analyzing the competitive environment of said specific entity.

66. A method as claimed in Claim 49 including the step of determining the real interest rate required by investors.

67. A method as claimed in Claim 49 including the step of determining the repayment period of the Income Growth Securities.

68. A method as claimed in Claim 49 including the step of determining the borrowing needs of said specific entity.

69. A method as claimed in Claim 49 including the step of restructuring existing debt when the borrowing needs of the entity exceed the entity's capacity to borrow.

70. The method of Claim 49 including the steps of:

a. limiting the scope of the entity to be considered in collecting historical performance data;

b. testing said historical performance data for seasonality;

c. if seasonality is present, altering said historical performance data to yield deseasonalized data;

d. calculating the real exchange rate between two selected countries, one country being the country whose actual inflation rate will determine the characteristics of the Income Growth Security;

e. analyzing the competitive environment of said limited specific entity;

f. determining the capacity of said specific entity to borrow;

g. determining the real interest rate required by investors;

h. determining the repayment period;

i. determining borrowing needs of said specific entity or related entity; and wherein

j. said performance data is calculated without a fixed cost component; and k. said performance data are calculated by one of the following formulas: revenues minus costs divided by costs or revenues minus costs divided by revenues.

71. An improved financing system for the borrowing needs of an entity comprising:

a. a computer wherein collected financial data relating to an entity is stored and wherein collected financial data relating to a selected country or countries is stored;

b. means for computing a regression of said entity's financial data on said financial data of said country or countries;

c. means for determining significance of a statistical relationship between said entity's financial data and said financial data of said country or countries;

d. means for determining a potential hedge amount; and

e. m ans for determining the amount of financing using Income Gr wth S curities.

72. A system as claim d in Claim 71 including means for converting the amount of financing to the currency of the country in which the funds are required.

73. A system as claimed in Claim 71 including:

a. means for determining additional financing needs; and

b. means for adjusting said financing needs.

74. A structure as claimed in claim 71 including:

a. means for generating performance simulations; and

b. means for considering the entity's risk preferences.

75. A system as claimed in Claim 71 including:

a. means for determining the potential hedge amount;

b. means for converting the amount of financing to the currency of the country in which the funds are required;

c. means for determining additional financing needs; and

d. means for adjusting said financing needs.

76. A system as claimed in Claim 71 in which the financial data is a measure of performance.

77. A system as claimed in Claim 76 in which the measure of performance is revenues.

78. A system as claimed in Claim 76 in which the measure of performance is revenues minus costs divided by costs.

79. A system as claimed in claim 76 in which the measure of performance is revenues minus costs divided by revenues.

80. A system as claimed in Claim 71 wherein the financial data are real exchange rates between two selected

e. means for determining the amount of financing using Income Growth S curities.

72. A system as claimed in Claim 71 including means for converting the amount of financing to the currency of the country in which the funds are required.

73. A system as claimed in Claim 71 including:

a. means for determining additional financing needs; and

b. means for adjusting said financing needs.

74. A structure as claimed in claim 71 including:

a. means for generating performance simulations; and

b. means for considering the entity's risk preferences.

75. A system as claimed in Claim 71 including:

a. means for determining the potential hedge amount;

b. means for converting the amount of financing to the currency of the country in which the funds are required;

c. means for determining additional financing needs; and

d. means for adjusting said financing needs.

76. A system as claimed in Claim 71 in which the financial data is a measure of performance.

77. A system as claimed in Claim 76 in which the measure of performance is revenues.

78. A system as claimed in Claim 76 in which the measure of performance is revenues minus costs divided by costs.

79. A system as claimed in claim 76 in which the measure of performance is revenues minus costs divided by revenues.

80. A system as claimed in Claim 71 wherein the financial data are real exchange rates between two selected

countries, one country being the country whose realized inflation will determine the characteristics of the Income Growth Security.

81. A system as claimed in Claim 71 wherein the financial data are the cumulative realized inflation of selected countries.

82. An improved debt structuring system comprising:

a. means for collecting historical performance data of a specific entity;

b. means for collecting historical inflation data of a selected country;

c. means for comparing said performance data and said inflation data to determine whether a correlation exists; and

d. means for issuing debt securities paying an interest rate which is a function of the actual inflation rate of said selected country.

83. A system as claimed in Claim 82 wherein the collection of said historical performance data includes means for testing the seasonality of said performance data.

84. A system as claimed in Claim 82 in which:

a. the said financial data of said country or countries are inflation data; and including

b. a means for showing a correlation between said performance data and said inflation data of a country; and

c. if a correlation exists, a means for issuing Income Growth Securities paying an interest rate which is a function of the realized inflation rate of the country for which said correlation exists.

85. A method for providing an improved financing system comprising the steps of:

a. selecting an industry;
b. coll cting hist rical financial data relating to said industry;
c. collecting historical financial data relating to a selected country or countries;
d. computing a regression of said industry's historical financial data on said financial data of said country or countries; and
e. determining significance of the statistical relationship between said industry's historical financial data and historical financial data of said country or countries.

86. A method as claimed in Claim 85 wherein:
a. said industry's historical financial data is a measure of performance; and
b. said country's historical financial data are real exchange rates.

87. A method as claimed in Claim 85 wherein:
a. said industry's historical financial data is operating markup; and
b. said country's historical financial data are real exchange rates.

88. A method as claimed in Claim 85 wherein:
a. said industry's historical financial data are price indices; and
b. said historical financial data of said country or countries are real exchange rates.

89. A method as claimed in Claim 85 wherein:
a. said industry's historical financial data is operating margin; and b. said country's historical financial data are real exchange rates.

90. A method as claimed in Claim 85 wherein:
a. said industry's historical financial data are cost indices; and

b. said hist rical financial data of said country or c untries are real exchange rates.

91. A method as claimed in claim 85 wh rein:

a. said industry's historical financial data are price indices; and

b. said historical financial data of said country or countries are inflation indices.

92. A method as claimed in claim 85 wherein:

a. said industry's historical financial data are operating profits; and

b. said historical financial data of said country or countries are inflation indices.

93. A method as claimed in Claim 85 wherein:

a. said industry's historical financial data are cost indices; and

b. said historical financial data of said country or countries are inflation indices.

94. An improved financing system comprising:

a. means for selecting an industry;

b. a computer wherein collected selected historical financial data relating to said industry are stored and wherein selected historical financial data relating to selected country or countries are stored;

c. means for computing a regression of said industry's said historical financial data on said historical financial data of said country or countries; and

d. means for determining significance of statistical relationship between said industry's historical financial data and said historical financial data of said country or countries.

95. A system as claimed in Claim 94 wherein:

a. said industry's historical financial data is a measure of performance; and
b. said historical financial data of said country or countries are real exchange rates.

96. A system as claimed in Claim 94 wherein:
a. said industry's historical financial data are price indices; and
b. said historical financial data of said country or countries are real exchange rates.

97. A system as claimed in Claim 94 wherein:
a. said industry's historical financial data are operating profit data; and
b. said historical financial data of said country or countries are real exchange rates.

98. A system as claimed in Claim 94 wherein:

a. said industry's historical financial data are cost indices; and
b. said historical financial data of said country or countries are real exchange rates.

99. A system, as claimed in claim 94 wherein:
a. said industry's historical financial data are price indices; and
b. said historical financial data of said country or countries are inflation indices.

100. A system as claimed in Claim 94 wherein:
a. said industry's historical financial data are operating profits; and
b. said historical financial data of said country or countries are inflation indices.

101. A system as claimed in claim 94 wherein:
a. said industry's historical financial data are cost indices; and
b. said historical financial data of said country or countries are inflation indices.

102. A structur as claimed in Claim 94 wherein:

a. said industry's hist rical financial data is perating markup; and

b. said country's historical financial data are real exchange rates.

103. A system as claimed in Claim 94 wherein:

a. said industry's historical financial data is operating margin;and

b. said country's historical financial data are real exchange rates.

104.A method for providing an improved financing system comprising the steps of:

a. selecting an industry;

b. collecting selected historical financial data relating to said industry;

C. collecting selected historical financial data relating to a selected country or countries;

d. computing a regression of said industry's said historical financial data on said financial data of said country or countries; and

e. determining significance of the statistical relationship between said industry's said historical financial data and said historical financial data of said country or countries.

f. selecting a firm from said industry if significance is established;

g. collecting historical financial data relating to said firm;

h. computing a regression of said firm's historical financial data on historical financial data of said country or countries;

i. determining significance of statistical relationship between said firm's historical

financial data and historical financial data of said country or countries; and

j. determining the amount of borrowing of said firm if significance is established.

105. A method as claimed in Claim 104 including the steps of:

a. determining a potential hedge amount;

b. determining additional financing needs; and

c. converting the financing needs to the currency of the country in which the funds are needed.

106. A method as claimed in Claim 104 wherein:

a. said historical financial data relating to the industry and the firm are measures of performance; and

b. said historical financial data relating to the country or countries are real exchange rates.

107. A method as claimed in Claim 104 wherein:

a. said industry's and firm's historical financial data are operating profit data or operating markup or operating margin; and

b. said historical financial data relating to the country or countries are real exchange rates.

108. A method as claimed in Claim 104 wherein:

a. said industry's and firm's historical financial data are price indices; and

b. said historical financial data relating to the country or countries are real exchange rates.

109. A method as claimed in Claim 104 wherein:

a. said industry's and firm's historical financial data are cost indices; and

b. said historical financial data relating to th country r c untries ar real exchange rates.

110. A method as claimed in Claim 104 wherein:

a. said historical financial data relating to the industry and the firm are measures of performance; and

b. said historical financial data relating to the country or countries are inflation rates.

111. A method as claimed in Claim 104 wherein:

a. said industry's and firm's historical financial data are operating profit data; and

b. said historical financial data relating to the country or countries are inflation rates.

112. A method as claimed in Claim 104 wherein:

a. said industry's and firm's historical financial data are price indices; and

b. said historical financial data relating to the country or countries are inflation rates.

113. A method as claimed in Claim 104 wherein:

a. said industry's and firm's historical financial data are cost indices; and

b. said historical financial data relating to the country or countries are inflation rates.

114. An improved financing system comprising:

a. means for choosing a selected industry;

b. a computer where collected historical financial data relating to said industry and collected selected historical financial data relating to a selected country or countries are stored;

c. means for computing a regression of said industry's said historical financial data on said financial data of said country or countries;

d. means for d termining significance f the statistical r lati nship between said industry's said historical financial data and said historical financial data of said country or countries;

e. means for choosing a firm from said industry if significance is found;

f. computer means for collecting and storing historical financial data relating to said firm;

g. means for computing a regression of said firm's said financial data on said historical financial data of said country or countries;

h. means for determining significance of statistical relationship between said firm's said historical financial data and said historical financial data of said country or countries;

i. means for determining the amount of borrowing of said firm if significance is found.

115. A system as claimed in claim 114 including:

a. means for determining potential hedge amounts;

b. means for converting the financing needs to the currency of the country in which the funds are needed;

c. means for determining additional financing needs; and

d. means for adjusting said financing needs.

116. A system as claimed in Claim 114 wherein:

a. said firm's historical financial data is operating markup: and

b. said historical financial data relating to the said country or countries are real exchange rates.

117. A system as claimed in claim 114 wherein:

a. said firm's hist rical financial data is perating margin; and

b. said historical financial data relating to the said country or countries are real exchange rates.

118. A system as claimed in Claim 114 wherein:

a. said firm's historical financial data are operating profits or price indices or cost indices; and

b. said historical financial data relating to the country or countries are inflation rates.

119. A method for providing an improved financing and investing system comprising the steps of:

a. borrowing a sum of money by issuing an Income Growth Security paying an interest rate having two factors, a real interest factor and a factor reflecting actual inflation of a first country; and

b. investing at least a portion of said borrowed money in an Income Growth Security issued in a second country.

120. A method for providing an improved investing system comprising the steps of:

a. defining the amount of money to be invested to meet future liabilities;

b. investing said money in Income Growth Securities and risky assets;

c. considering risk preferences of the investor to allocate money between risky assets and Income Growth Securities;

d. estimating the expected real returns and covariances between real returns of asset classes to be considered in a portfolio; and

e. determining the mix of risky ass ts using a model of asset allocation with the said inputs.

121. A method for providing an improved investing system comprising the steps of:

a. defining the amount of money to be invested to provide a future real annuity over a known future period;

b. investing said money in Income Growth Securities and risky assets;

c. considering risk preferences of the investor to allocate money between risky assets and Income Growth Securities;

d. estimating the expected real returns and covariances between real returns of asset classes to be considered in a portfolio; and

e. determining the mix of risky assets using a model of asset allocation with the said inputs.

122. A method for providing an improved investing system comprising the steps of:

a. determining, including assisting in the determination, that an entity has a desire to fund a future liability which liability is expected to increase at least in part with inflation; and

b. investing, including assisting in the investing, in an Income Growth Security to at least partially fund said future liability.

123. A method as claimed in Claim 122 wherein the entity is, a pension plan and said future liability is the future active lives' liability of a defined benefit pension plan.

124. A method as claimed in Claim 122 wherein the entity is an insurance company which desires to fund future liabilities.

125. A method for providing an improved investing system comprising the steps of:

a. determining, including assisting in the determination, that an entity has a desire to fund a future annuity, which is required to increase at least in part with inflation; and

b. investing, including assisting in the investing, in an Income Growth Security to at least partially fund said future annuity.

126. A method for providing an improved investing System comprising the steps of:

a. determining that an entity has a desire to invest an amount of money today to ensure an increase in its purchasing power in the future; and

b. investing at least part of said money in an Income Growth Security.

127. A method as claimed in Claim 126 wherein the entity is a retirement fund.

128. A method as claimed in claim 126 wherein the entity is an endowment.

129. A method for providing an improved investing system comprising the steps of:

a. assisting in the determination that a entity has a desire to fund a future liability which liability is expected to increase at least in part with inflation; and

b. investing in an Income Growth Security to at least partially fund said future liability,

130. A method for providing an improved investing system comprising the steps of:

a. assisting in the determination that an entity has a desire to invest an amount of money today to insure an increase in its purchasing power in the future; and

b. assisting in investing at least part of said money in an Income Growth Security.

131. A method for providing an improved pension plan investment system which optimize the ability of plan assets to fund future liabilities which are expected to increase at least in part with inflation comprising the steps of:

a. calculating the accumulated benefit obligation for a given future year;

b. calculating the future active lives liability in today's dollars for said future year by modifying the cumulative benefit obligation for such factors as employee turnover, changes in grade mix, change in number of employees from the present to future year and accumulated years of service, without allowance for inflation;

c. calculating the present value of the future active lives liability by discounting the future active lives liability in today's dollars at a real interest rate; and

d. determining the risk preferences of the plan sponsor;

e. allocating funds between Income Growth Securities and risky assets;

f. calculating expected real returns and covariances between real returns on asset classes; and

g. calculating a mix of risky assets with said inputs.

132. A method as claimed in claim 131 including the step of simultaneously considering the effect of inflation on the growth of assets and liabilities.

133. An improved pension plan investment system comprising:

a. means for defining the accumulated benefit obligation for a given future year;

b. means obligation changes in present to service to for modifying the accumulated benefit as a function of employee turnover, grade mix, number of employees from the future and accumulated years of calculate the future active lives liability in today's dollars, without considering inflation;

c means for discounting the future active lives liability in today's dollars at a real interest rate;

d. means for determining risk preferences; and

e. means for determining in asset mix.

134. A system as claimed in Claim 133 including modelling means for asset allocation between risky assets.

135. A system as claimed in Claim 134 wherein said modelling means includes means for determining expected real returns for each asset class; and means for determining the covariances between the real returns for each asset class.

136. A method as claimed in Claim 1 or 2 wherein an entity's costs are determined at least in part by prices set in a given country and said entity invests in an Income Growth Security in the currency of said country.

137. A method as claimed in Claim 1 or 2 wherein an entity's costs are determined at least in part by prices set in a plurality of countries and said entity invests in Income Growth Securities in the currency or currencies of one or more said countries.

138. An impr v d system for borrowing and investing comprising:

a. a computer wher in c llected historical performance data of a specific entity and collected historical financial data for selected country or countries are stored;

b. means for comparing said performance data and said historical financial data for said country or countries to determine whether a correlation exists;

c. if a correlation exists with historical financial data for a specific country, means for issuing debt securities paying an interest rate which is a function of the realized inflation rate of said country;

d. means for defining the accumulated benefit obligation for a given future year;

e. means for modifying the accumulated benefit obligation to calculate the Future Active Lives Liability In Today's Dollars by taking into consideration employee turnover, changes in grade mix, number of employees from the present to the future and accumulated years of service, without taking into account inflation;

f. means for discounting the Future Active Lives Liability In Today's Dollars at a real interest rate;

g. means for determining risk preferences of a pension plan;

h. means for allocating assets between Income Growth Securities issued by said entity and risky assets;

transaction for which the security was issued to the end of $T-d$ periods for the payment made at the end of T periods; the first payment is made at the end of T periods; and payments are made at the end of every period thereafter to the final payment of the transaction at $T+N$, where N may be finite or infinite.

144. A method for providing an improved financing system comprising the step of issuing a security having a multiperiod repayment structure which repayment structure is a function of cumulative realized inflation.

145. A method as claimed in claim 144 in which said multiperiod repayment structure is infinite in length.

146. A method as claimed in claim 144 in which said multiperiod repayment structure is finite in length.

147. A method for providing an improved financing system comprising the step of issuing a security having a repayment that follows the expression:

$D(1 + I_T)$ at the end of T periods,

$D(1 + I_{T+1})$ at the end of T+1 periods,

$D(1 + I_{T+2})$ at the end of T+2 periods,

$D(1 + I_{T+N})$ at the end of T+N periods,

where D is a constant amount of money; I is cumulative realized inflation, expressed as a fraction, from the effective start of the transaction for which the security was issued; the first payment is made at the end of T periods; and payments are made at the end of every period thereafter to the final payment of the transaction at $T+N$, where N may be finite or infinite.

148. A method for providing an improved financing system comprising the step of issuing a security having a repayment that follows the expression:

$D(1 + I_{T-d})$ at the end of T periods,

$D(1 + I_{T+1-d})$ at the end of T+1 periods,

$D(1 + I_{T+2-d})$ at the end of T+2 periods,

$D(1 + I_{T+N-d})$ at the end of T+N periods,

where D is a constant amount of money; I is cumulative realized inflation, expressed as a fraction, from the end of d periods before the ff ctive start of the transaction for which the security was issued to the end of $T-d$ periods for the payment made at the end of T periods; the first payment is made at the end of T periods; and payments are made at the end of every period thereafter to the final payment of the transaction at $T+N$, where N may be finite or infinite.

149. A method as claimed in Claim 124 wherein the said future liabilities are the replacement costs of plant or equipment.

150. A method as claimed in Claim 1 or 2 in which the Income Growth Security is a debt instrument.

151. A method as claimed in claim 1 or 2 in which the Income Growth Security is an equity instrument.

152. A method as claimed in Claim 1 or 2 in which the Income Growth Security is a preferred stock.

153. A system as claimed in Claim 7 or 8 in which the Income Growth Security is a debt instrument.

154. A system as claimed in Claim 7 or 8 in which the Income Growth Security is an equity instrument.

155. A system as claimed in claim 7 or 8 in which the Income Growth Security is a preferred stock.

156. A method as claimed in claim 13 wherein said asset is the capital of a financial institution.

157. A system as claimed in Claim 32 or 33 wherein said asset is the capital of a financial institution.

158. A method as claimed in Claim 1 or 2 in which the rate of inflation is expected to be high.

159. A system as claimed in Claim 7 or 8 in which the rate of inflation is expected to be high.

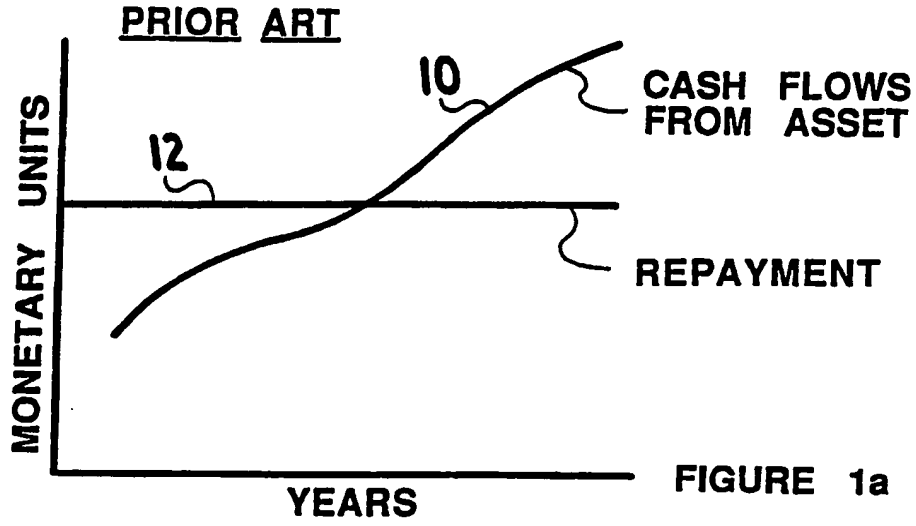

FIGURE 1a

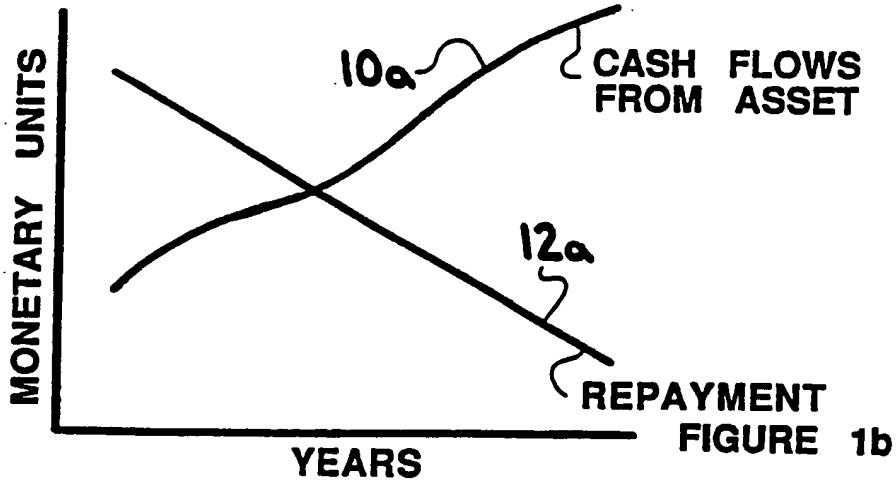

FIGURE 1b

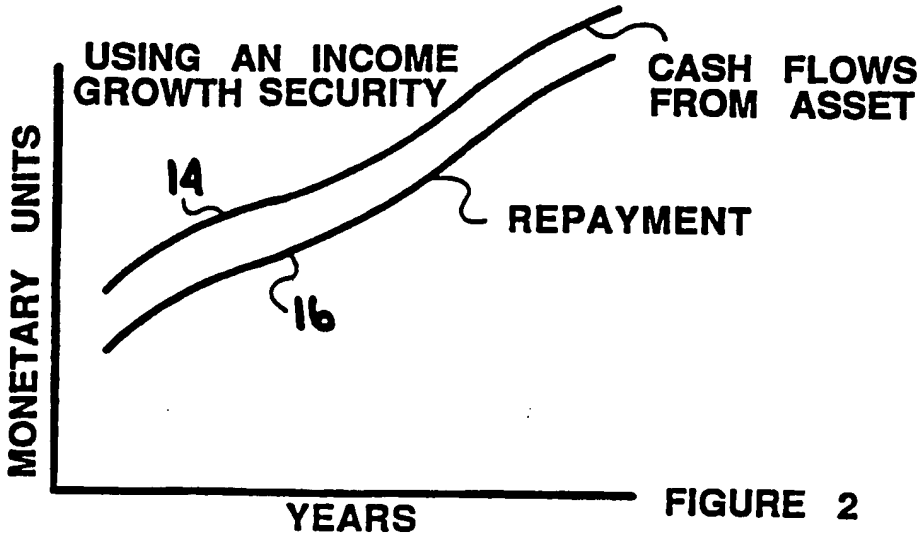

FIGURE 2

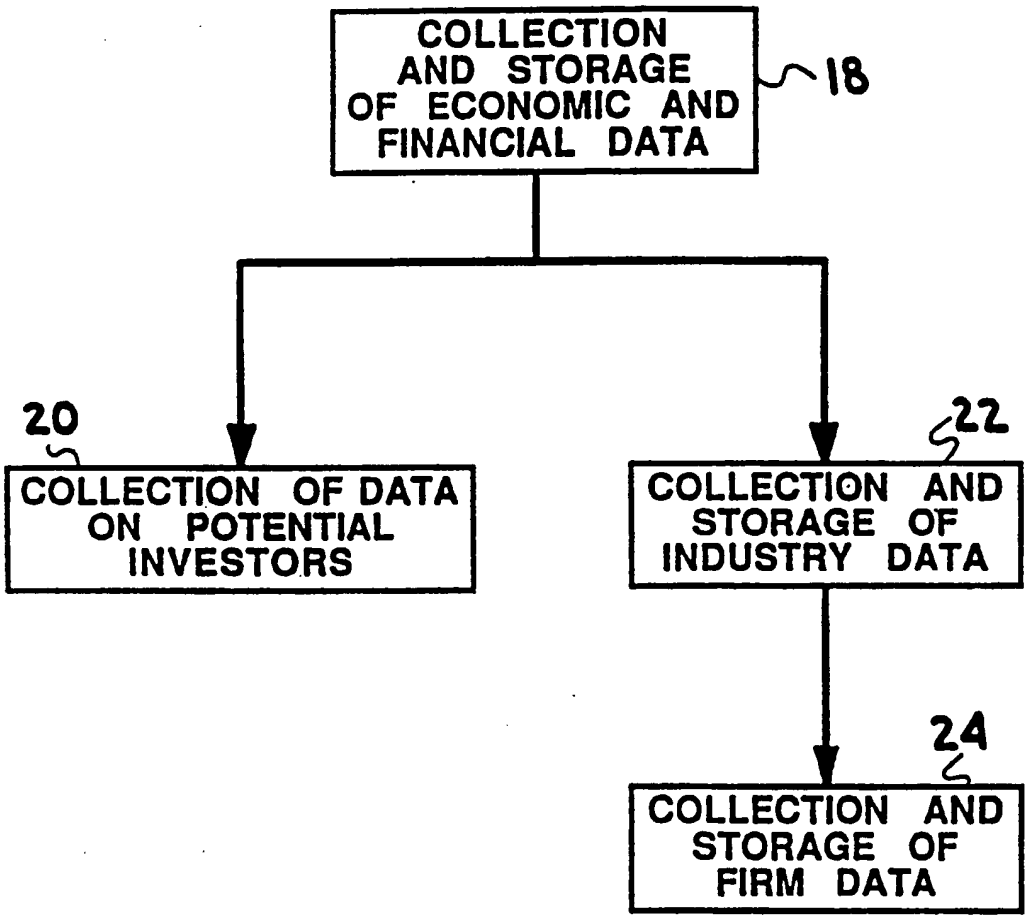
COLLECTION AND STORAGE OF ECONOMIC AND FINANCIAL DATA
18
20
COLLECTION OF DATA ON POTENTIAL INVESTORS
22
COLLECTION AND STORAGE OF INDUSTRY DATA
24
COLLECTION AND STORAGE OF FIRM DATA

FIGURE 3

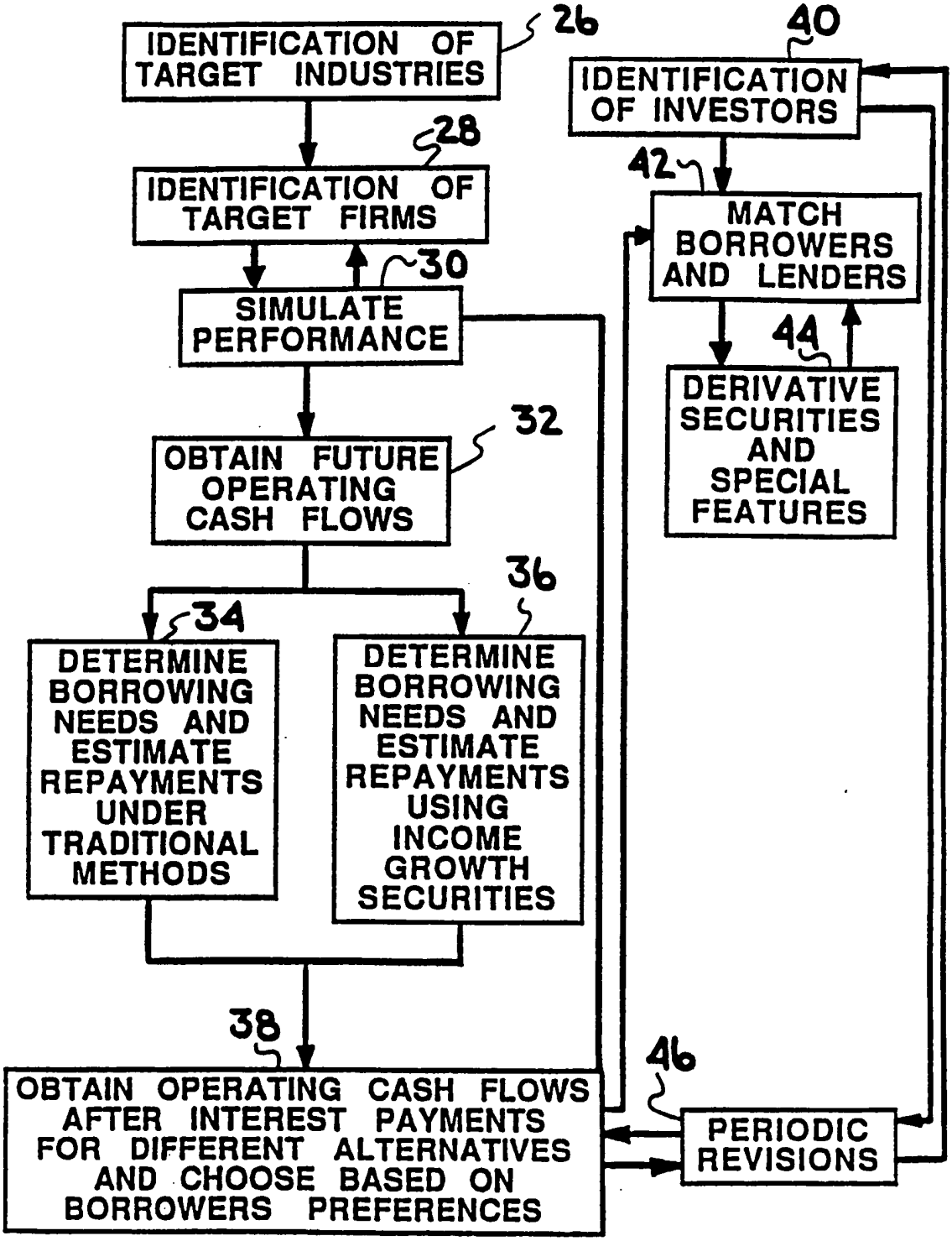

FIGURE 4

SUBSTITUTE SHEET

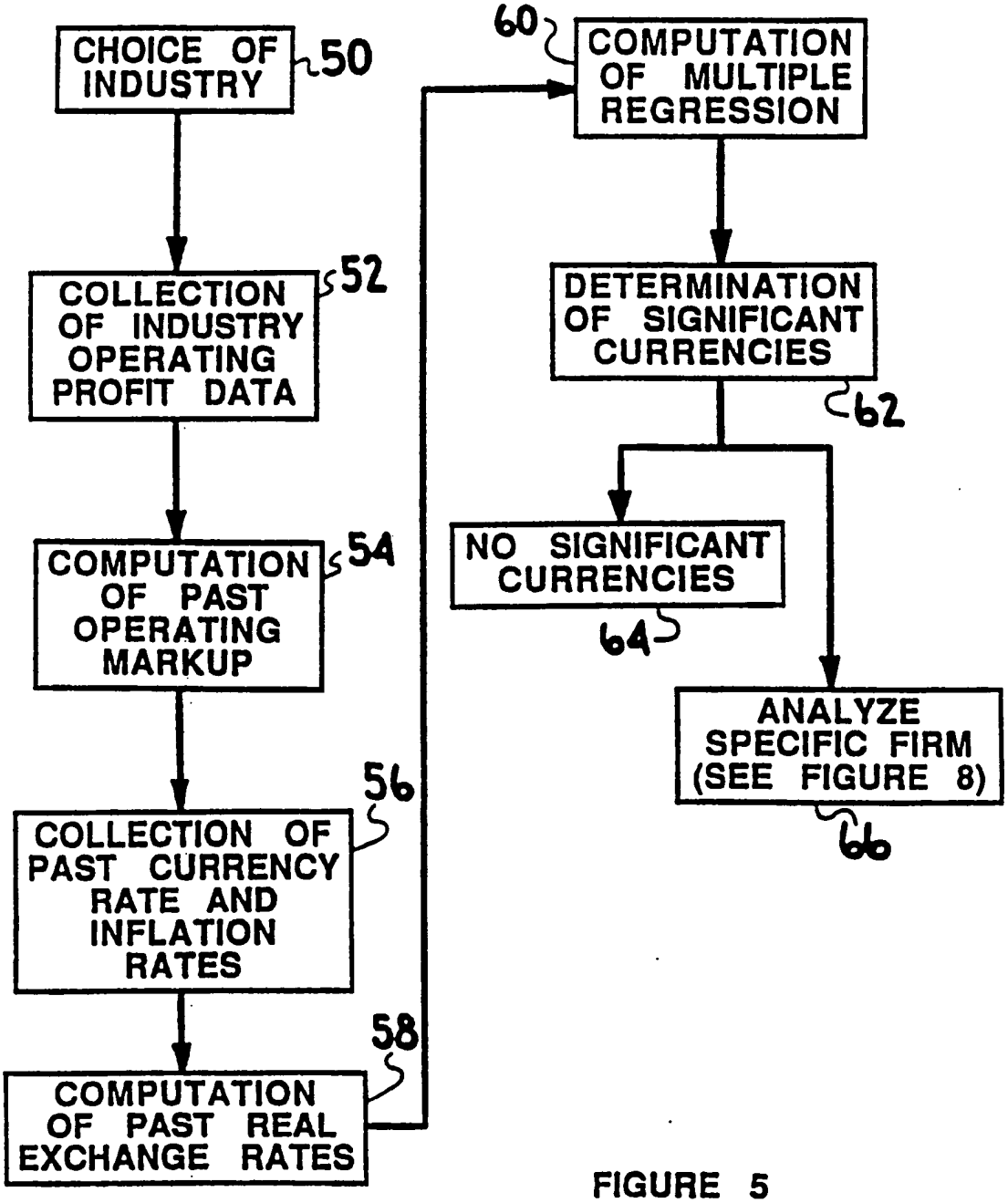
CHOICE OF INDUSTRY
50
COLLECTION OF INDUSTRY OPERATING PROFIT DATA
52
COMPUTATION OF PAST OPERATING MARKUP
54
COLLECTION OF PAST CURRENCY RATE AND INFLATION RATES
56
COMPUTATION OF PAST REAL EXCHANGE RATES
58
60
COMPUTATION OF MULTIPLE REGRESSION
DETERMINATION OF SIGNIFICANT CURRENCIES
62
NO SIGNIFICANT CURRENCIES
64
ANALYZE SPECIFIC FIRM (SEE FIGURE 8)
66

FIGURE 5

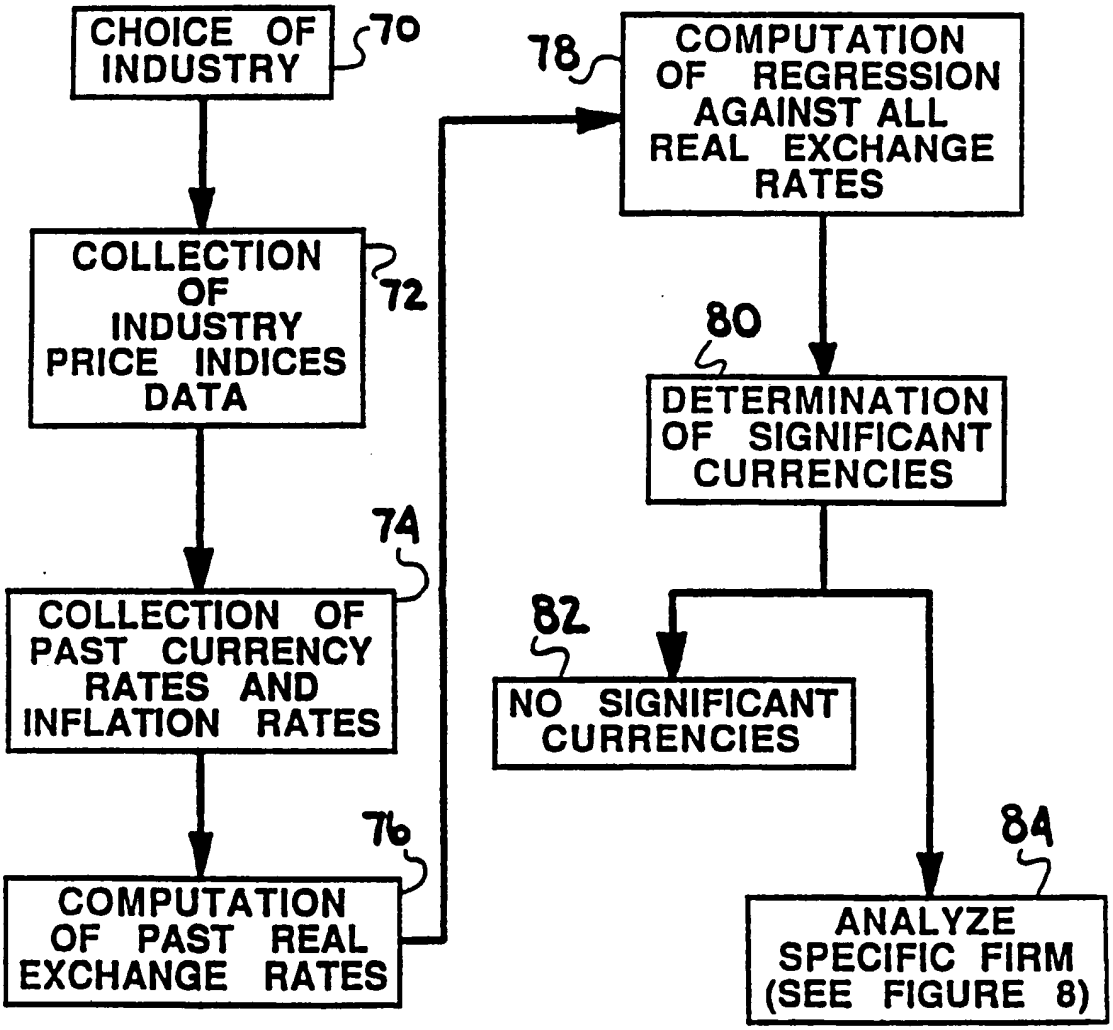
CHOICE OF INDUSTRY
70
COLLECTION OF INDUSTRY PRICE INDICES DATA
72
COLLECTION OF PAST CURRENCY RATES AND INFLATION RATES
74
COMPUTATION OF PAST REAL EXCHANGE RATES
76
COMPUTATION OF REGRESSION AGAINST ALL REAL EXCHANGE RATES
78
DETERMINATION OF SIGNIFICANT CURRENCIES
80
NO SIGNIFICANT CURRENCIES
82
ANALYZE SPECIFIC FIRM (SEE FIGURE 8)
84

FIGURE 6

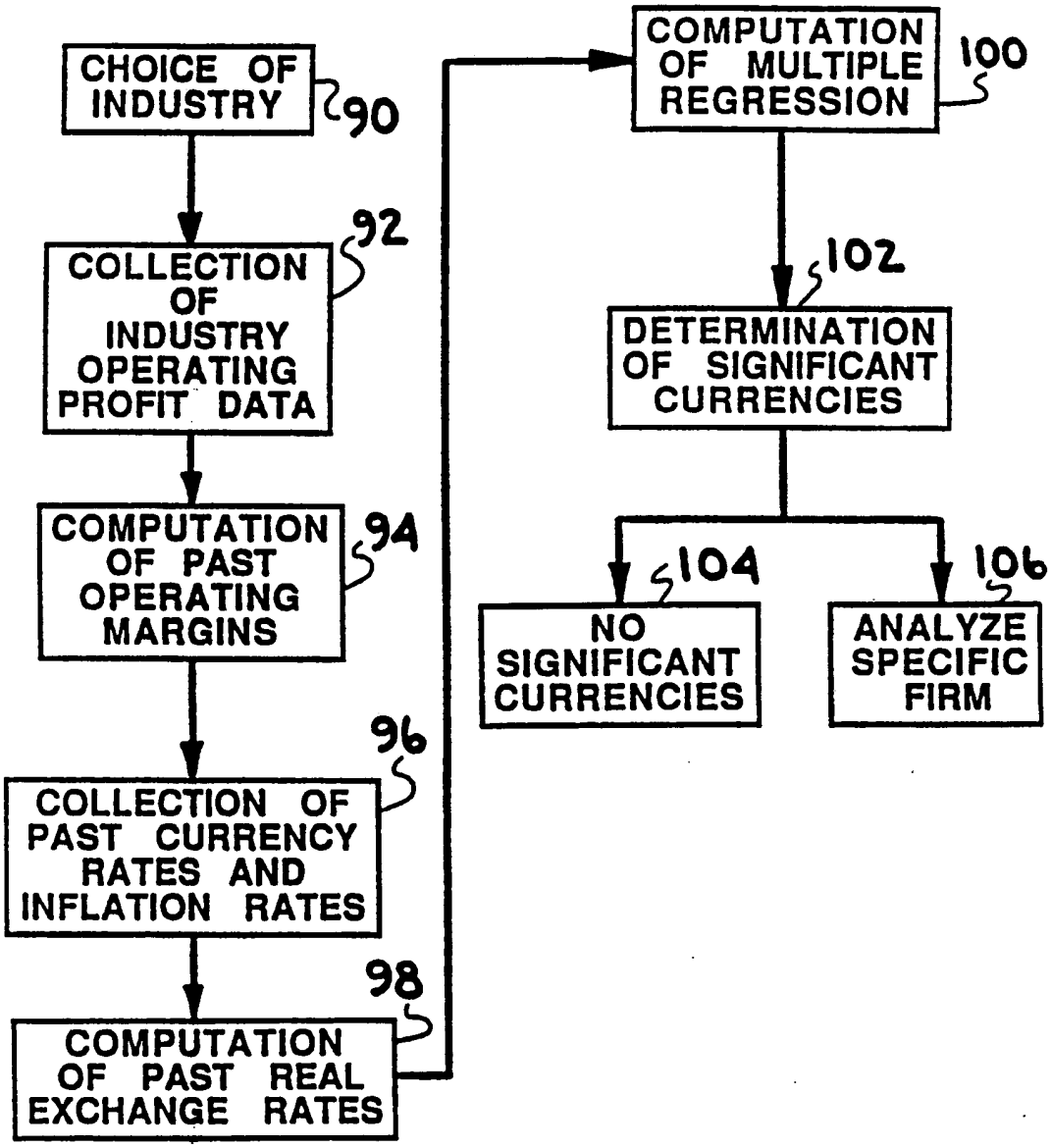
CHOICE OF INDUSTRY
90
COLLECTION OF INDUSTRY OPERATING PROFIT DATA
92
COMPUTATION OF PAST OPERATING MARGINS
94
COLLECTION OF PAST CURRENCY RATES AND INFLATION RATES
96
COMPUTATION OF PAST REAL EXCHANGE RATES
98
COMPUTATION OF MULTIPLE REGRESSION
100
DETERMINATION OF SIGNIFICANT CURRENCIES
102
NO SIGNIFICANT CURRENCIES
104
ANALYZE SPECIFIC FIRM
106

FIGURE 7

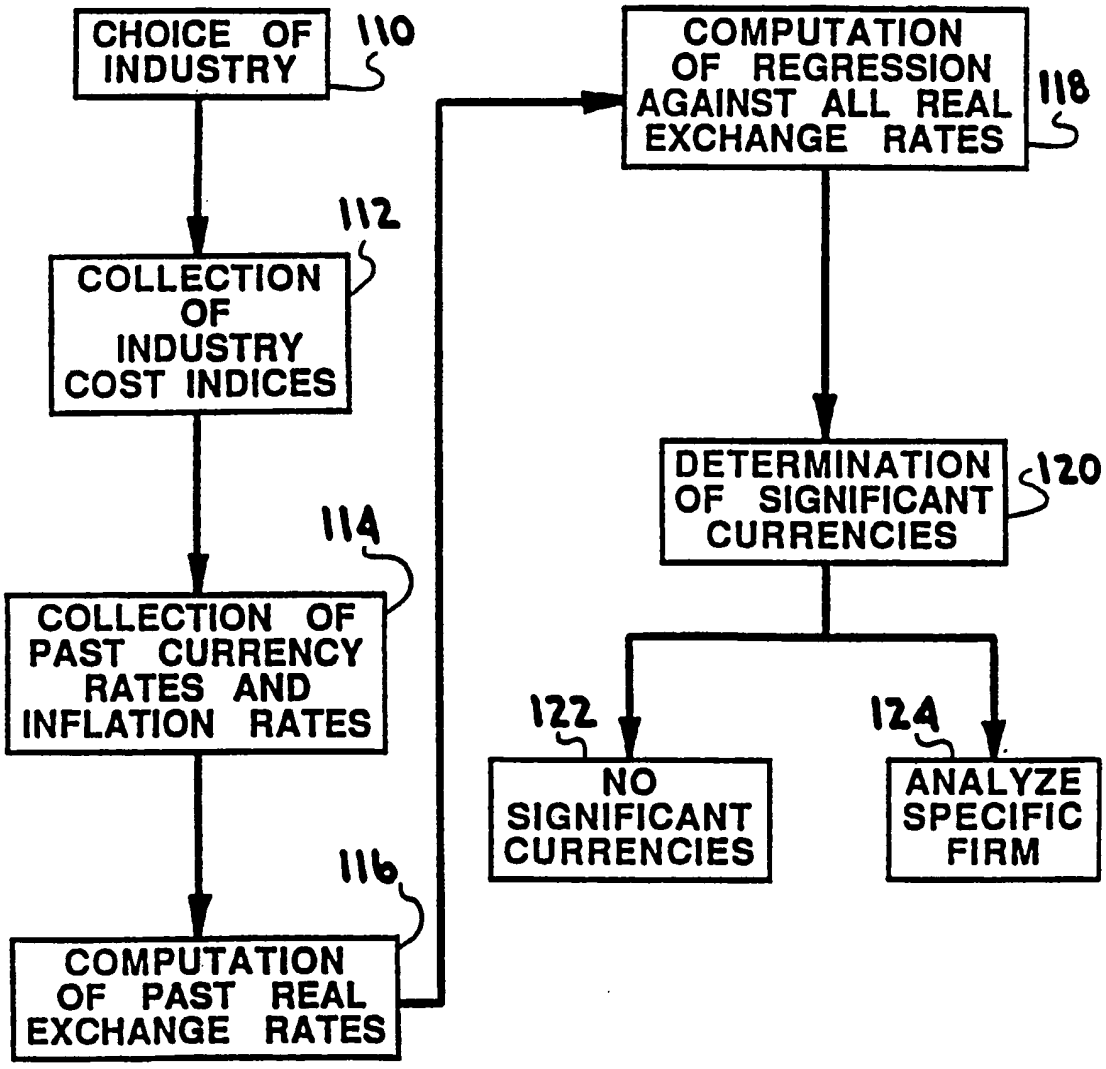
CHOICE OF INDUSTRY
110
COLLECTION OF INDUSTRY COST INDICES
112
COLLECTION OF PAST CURRENCY RATES AND INFLATION RATES
114
COMPUTATION OF PAST REAL EXCHANGE RATES
116
COMPUTATION OF REGRESSION AGAINST ALL REAL EXCHANGE RATES
118
DETERMINATION OF SIGNIFICANT CURRENCIES
120
NO SIGNIFICANT CURRENCIES
122
ANALYZE SPECIFIC FIRM
124

FIGURE 8

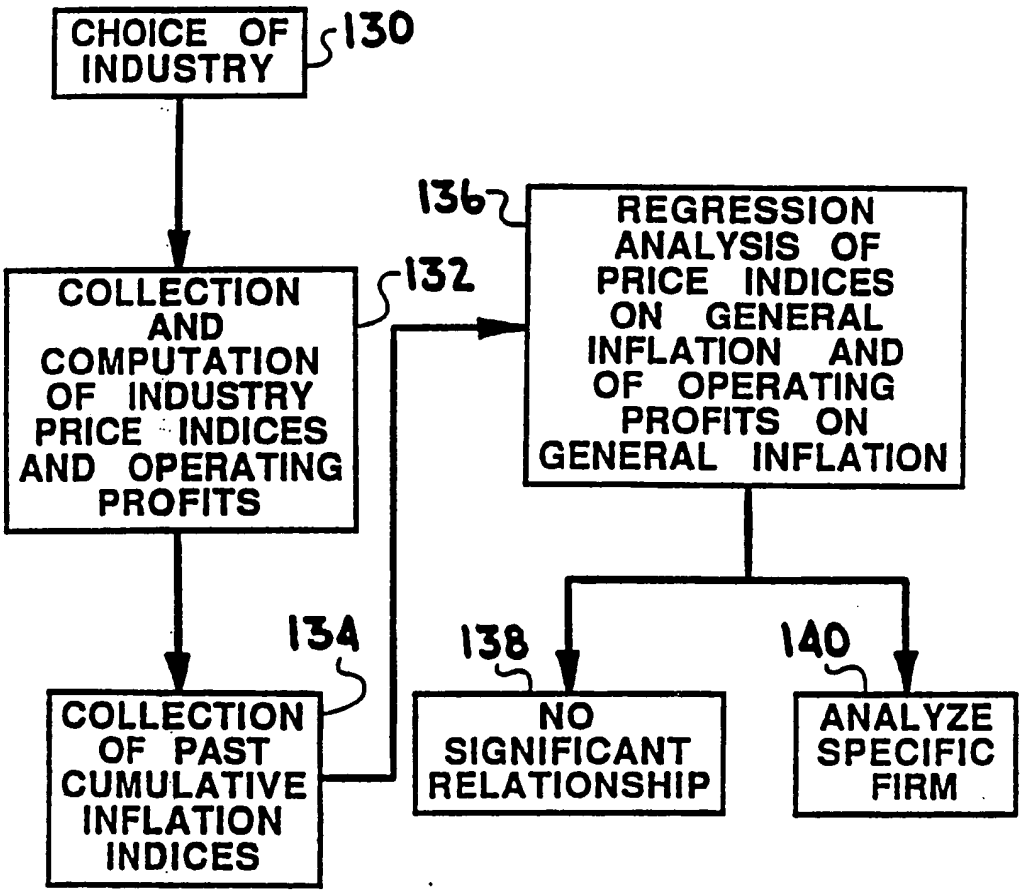
CHOICE OF INDUSTRY
130
COLLECTION AND COMPUTATION OF INDUSTRY PRICE INDICES AND OPERATING PROFITS
132
COLLECTION OF PAST CUMULATIVE INFLATION INDICES
134
136
REGRESSION ANALYSIS OF PRICE INDICES ON GENERAL INFLATION AND OF OPERATING PROFITS ON GENERAL INFLATION
138
NO SIGNIFICANT RELATIONSHIP
140
ANALYZE SPECIFIC FIRM

FIGURE 9

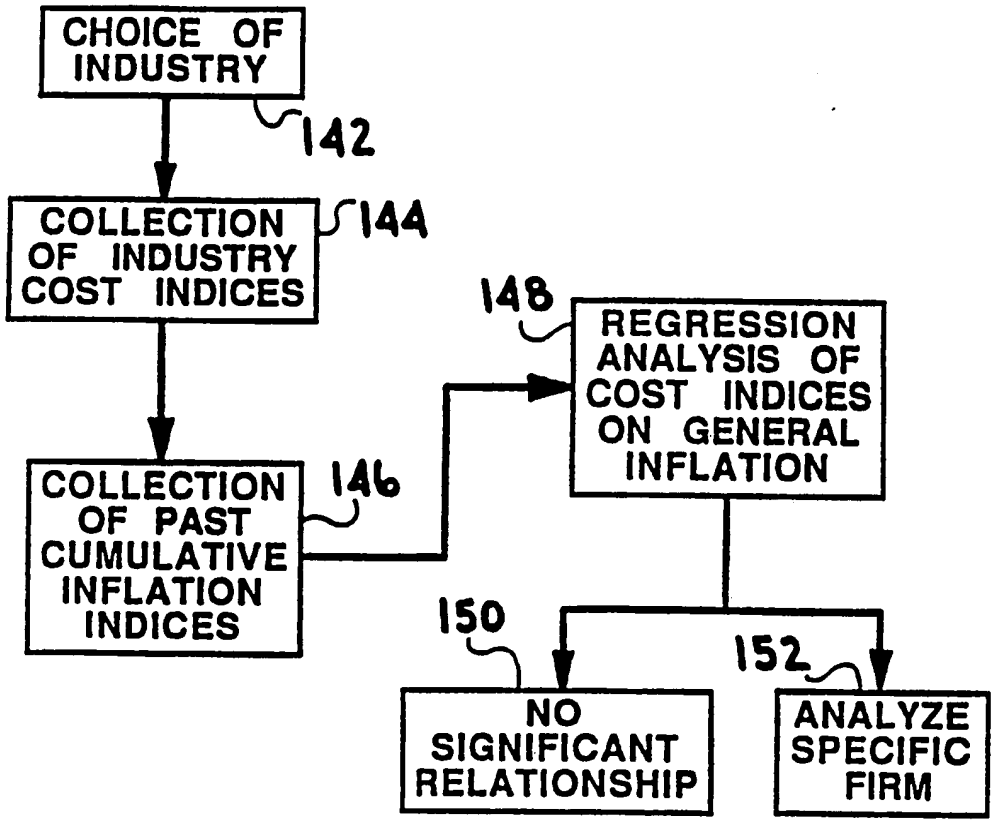
CHOICE OF INDUSTRY
142
COLLECTION OF INDUSTRY COST INDICES
144
148
REGRESSION ANALYSIS OF COST INDICES ON GENERAL INFLATION
COLLECTION OF PAST CUMULATIVE INFLATION INDICES
146
150
152
NO SIGNIFICANT RELATIONSHIP
ANALYZE SPECIFIC FIRM

FIGURE 10

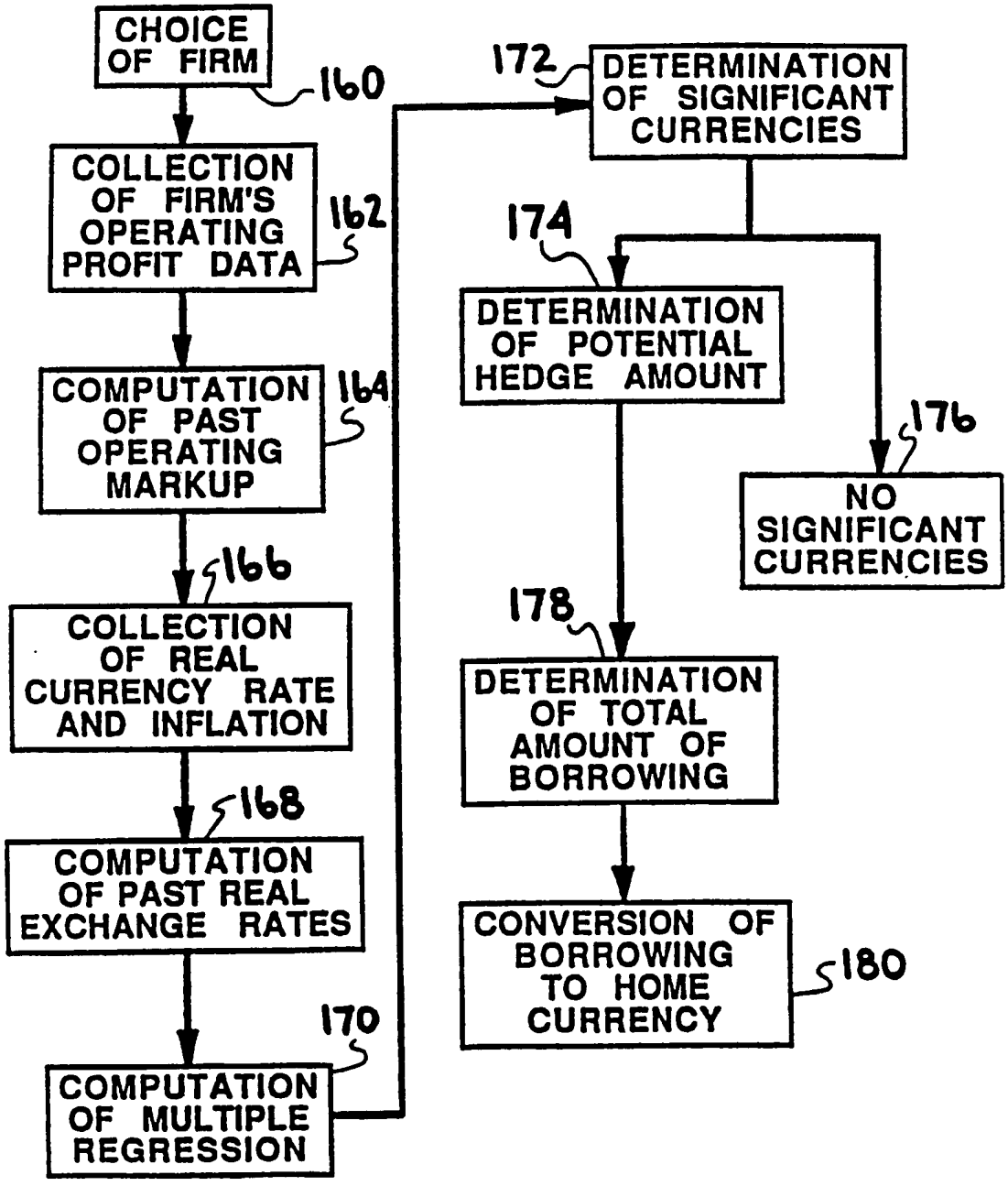
CHOICE OF FIRM
160
COLLECTION OF FIRM'S OPERATING PROFIT DATA
162
COMPUTATION OF PAST OPERATING MARKUP
164
166
COLLECTION OF REAL CURRENCY RATE AND INFLATION
168
COMPUTATION OF PAST REAL EXCHANGE RATES
170
COMPUTATION OF MULTIPLE REGRESSION
172
DETERMINATION OF SIGNIFICANT CURRENCIES
174
DETERMINATION OF POTENTIAL HEDGE AMOUNT
176
NO SIGNIFICANT CURRENCIES
178
DETERMINATION OF TOTAL AMOUNT OF BORROWING
CONVERSION OF BORROWING TO HOME CURRENCY
180

FIGURE 11

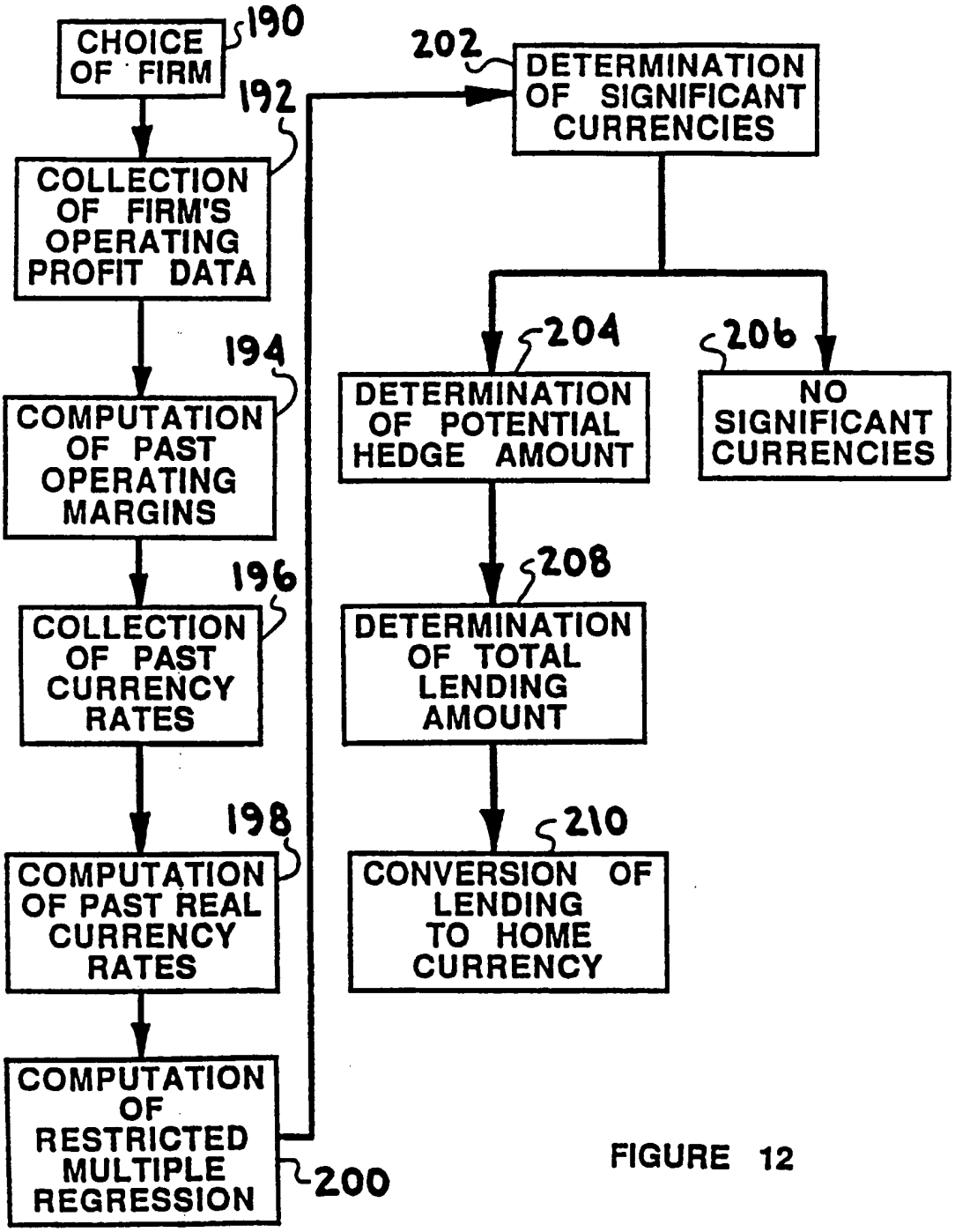
CHOICE OF FIRM
190
COLLECTION OF FIRM'S OPERATING PROFIT DATA
192
COMPUTATION OF PAST OPERATING MARGINS
194
COLLECTION OF PAST CURRENCY RATES
196
COMPUTATION OF PAST REAL CURRENCY RATES
198
COMPUTATION OF RESTRICTED MULTIPLE REGRESSION
200
DETERMINATION OF SIGNIFICANT CURRENCIES
202
DETERMINATION OF POTENTIAL HEDGE AMOUNT
204
NO SIGNIFICANT CURRENCIES
206
DETERMINATION OF TOTAL LENDING AMOUNT
208
CONVERSION OF LENDING TO HOME CURRENCY
210

FIGURE 12

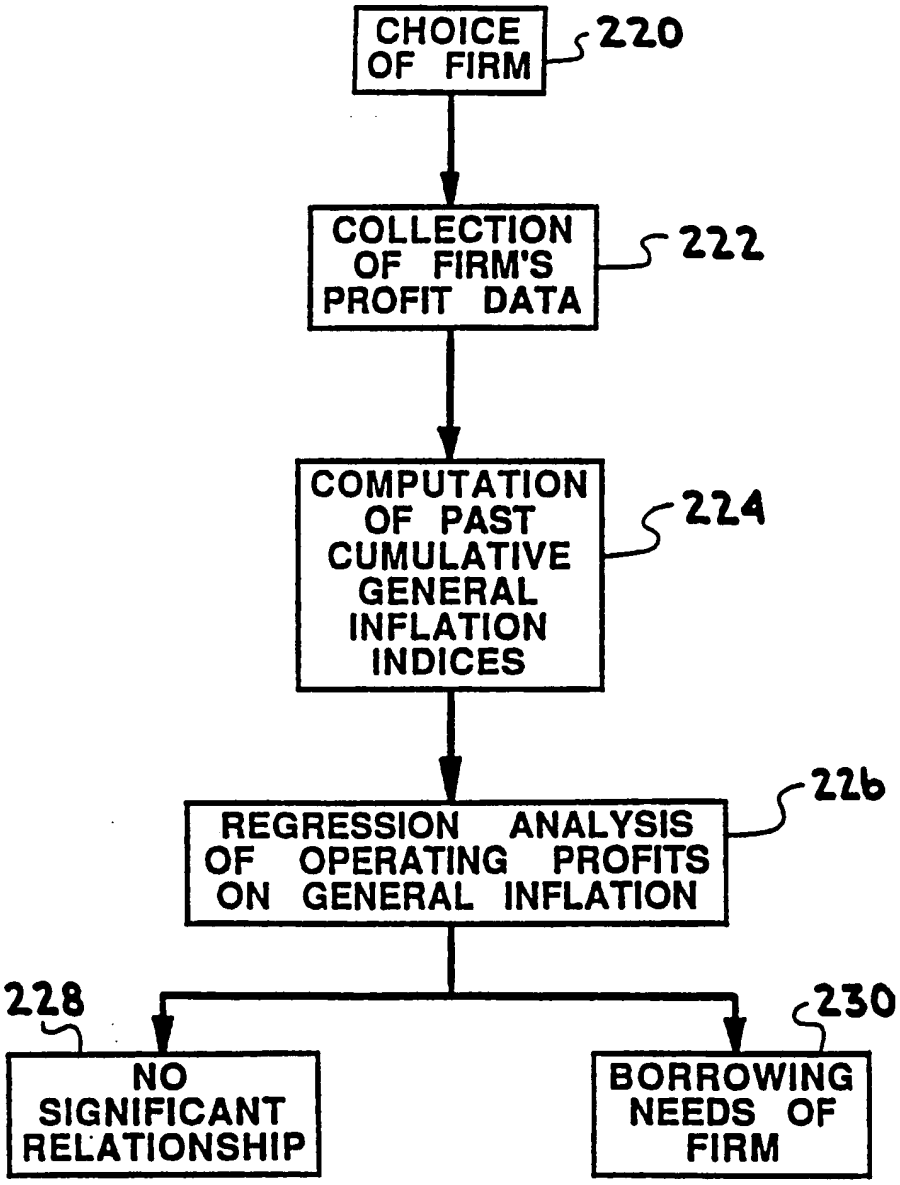
CHOICE OF FIRM
220
COLLECTION OF FIRM'S PROFIT DATA
222
COMPUTATION OF PAST CUMULATIVE GENERAL INFLATION INDICES
224
REGRESSION ANALYSIS OF OPERATING PROFITS ON GENERAL INFLATION
226
228
NO SIGNIFICANT RELATIONSHIP
230
BORROWING NEEDS OF FIRM

FIGURE 13

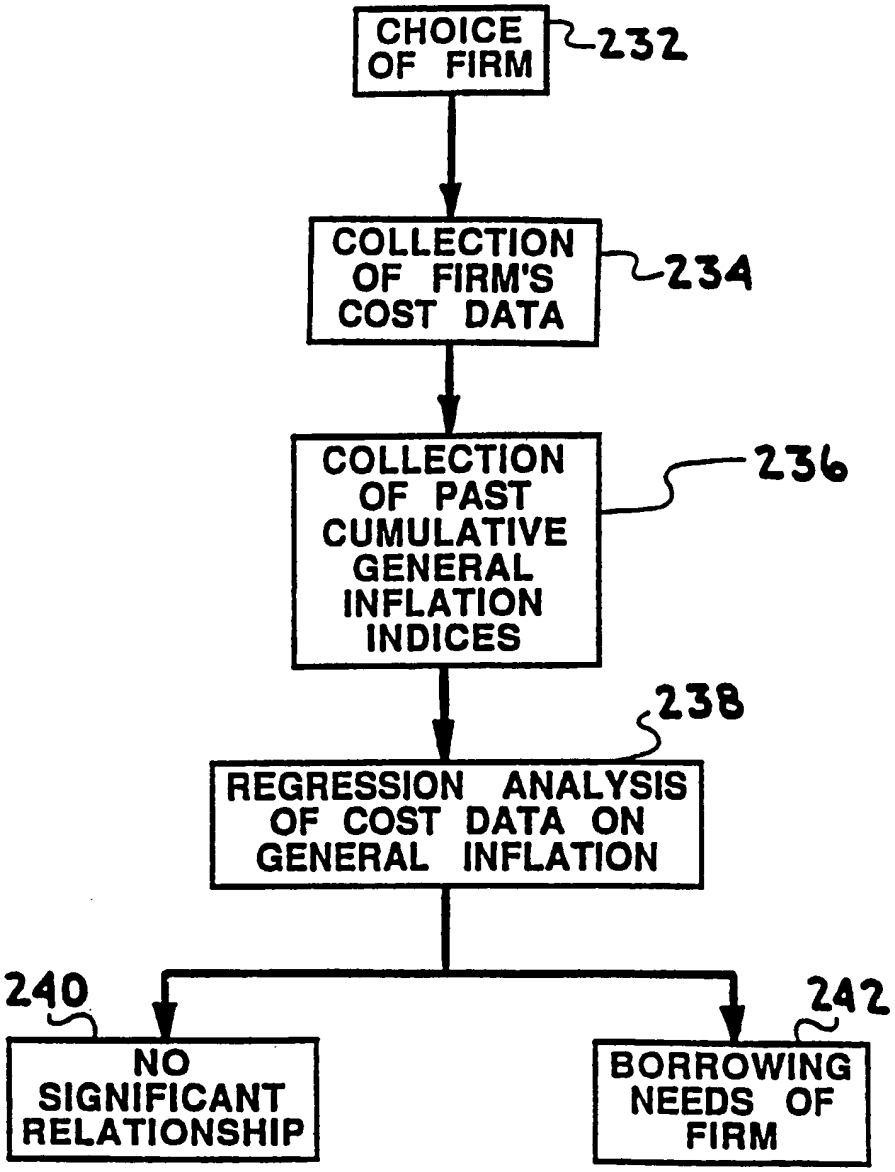
CHOICE OF FIRM
232
COLLECTION OF FIRM'S COST DATA
234
COLLECTION OF PAST CUMULATIVE GENERAL INFLATION INDICES
236
238
REGRESSION ANALYSIS OF COST DATA ON GENERAL INFLATION
240
NO SIGNIFICANT RELATIONSHIP
242
BORROWING NEEDS OF FIRM

FIGURE 14

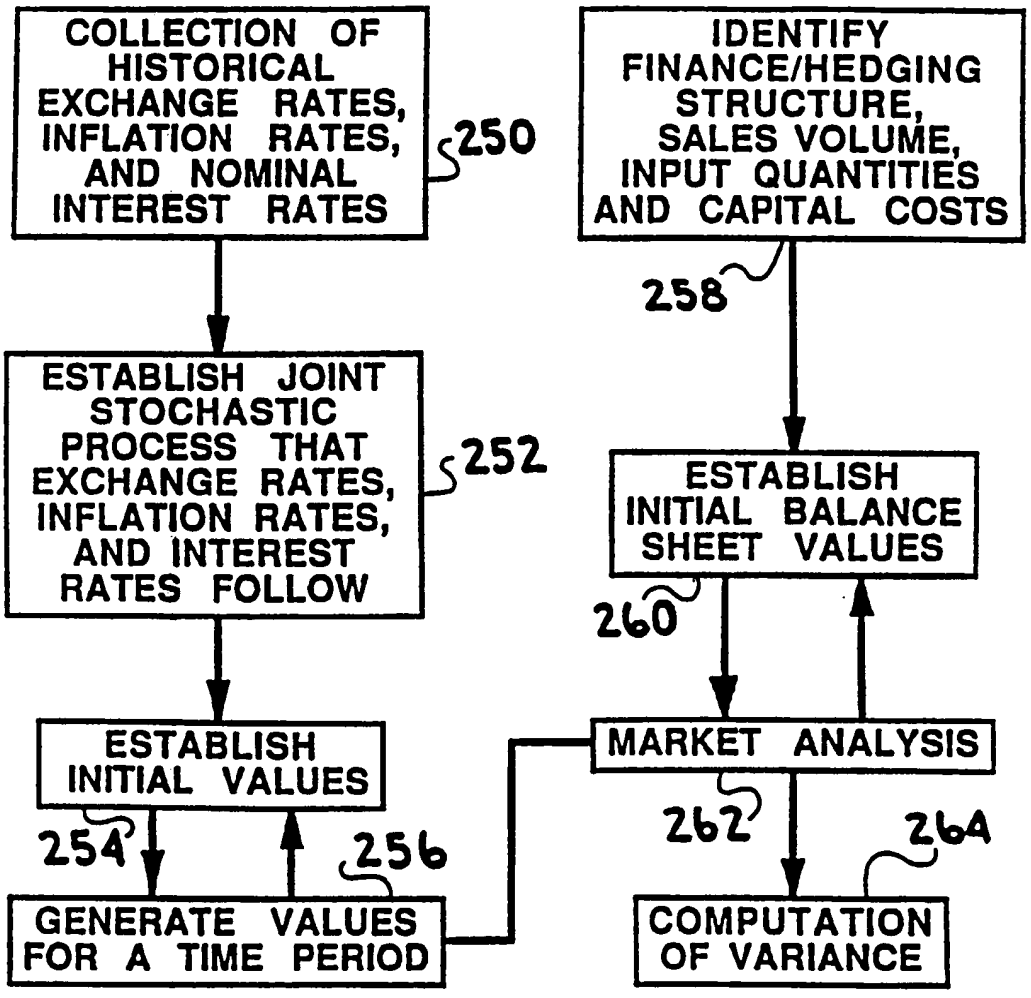
COLLECTION OF HISTORICAL EXCHANGE RATES, INFLATION RATES, AND NOMINAL INTEREST RATES
250
IDENTIFY FINANCE/HEDGING STRUCTURE, SALES VOLUME, INPUT QUANTITIES AND CAPITAL COSTS
258
ESTABLISH JOINT STOCHASTIC PROCESS THAT EXCHANGE RATES, INFLATION RATES, AND INTEREST RATES FOLLOW
252
ESTABLISH INITIAL BALANCE SHEET VALUES
260
ESTABLISH INITIAL VALUES
254
256
MARKET ANALYSIS
262
264
GENERATE VALUES FOR A TIME PERIOD
COMPUTATION OF VARIANCE

FIGURE 15

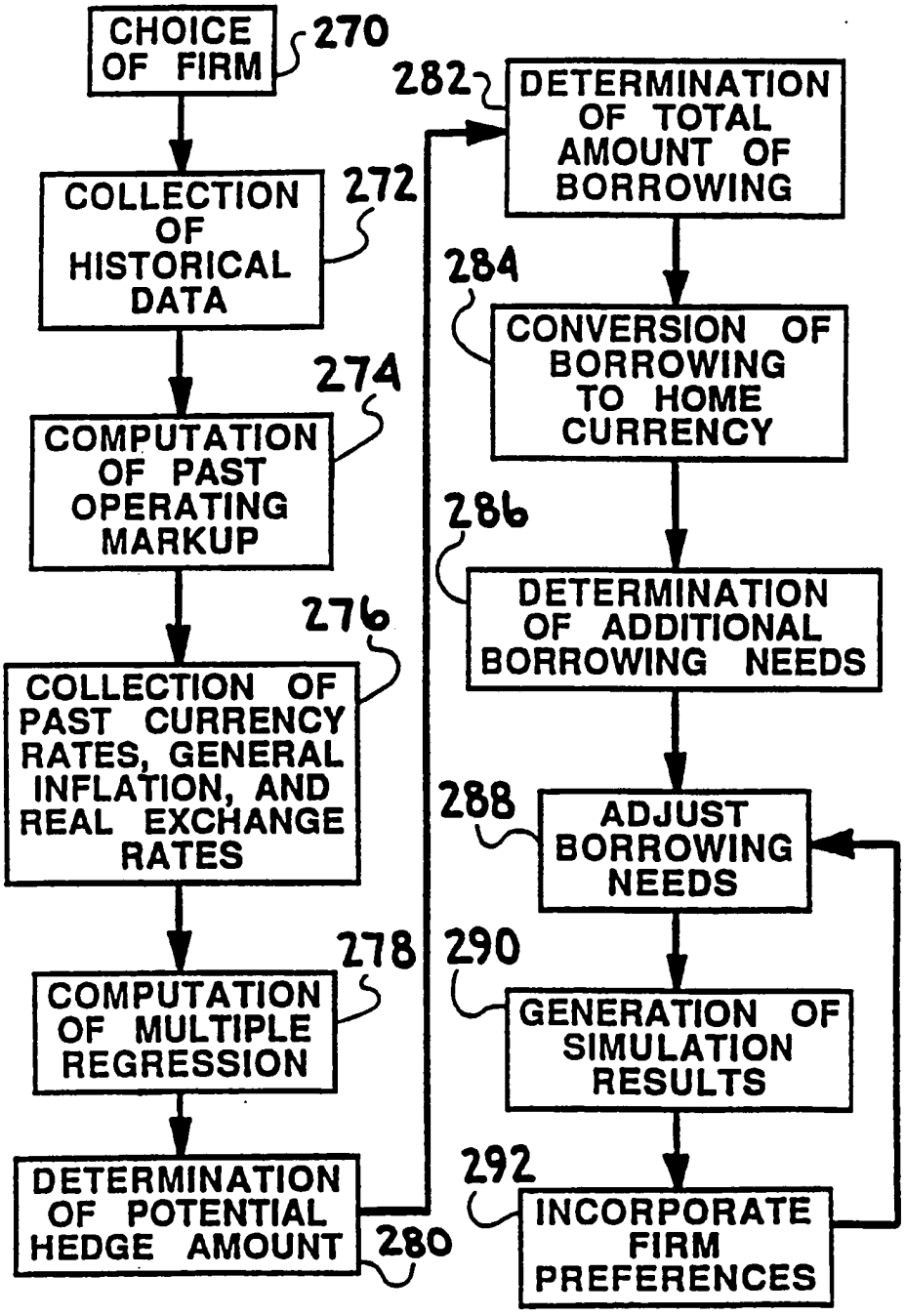
CHOICE OF FIRM
270
COLLECTION OF HISTORICAL DATA
272
COMPUTATION OF PAST OPERATING MARKUP
274
COLLECTION OF PAST CURRENCY RATES, GENERAL INFLATION, AND REAL EXCHANGE RATES
276
COMPUTATION OF MULTIPLE REGRESSION
278
DETERMINATION OF POTENTIAL HEDGE AMOUNT
280
DETERMINATION OF TOTAL AMOUNT OF BORROWING
282
CONVERSION OF BORROWING TO HOME CURRENCY
284
DETERMINATION OF ADDITIONAL BORROWING NEEDS
286
ADJUST BORROWING NEEDS
288
GENERATION OF SIMULATION RESULTS
290
INCORPORATE FIRM PREFERENCES
292

FIGURE 16

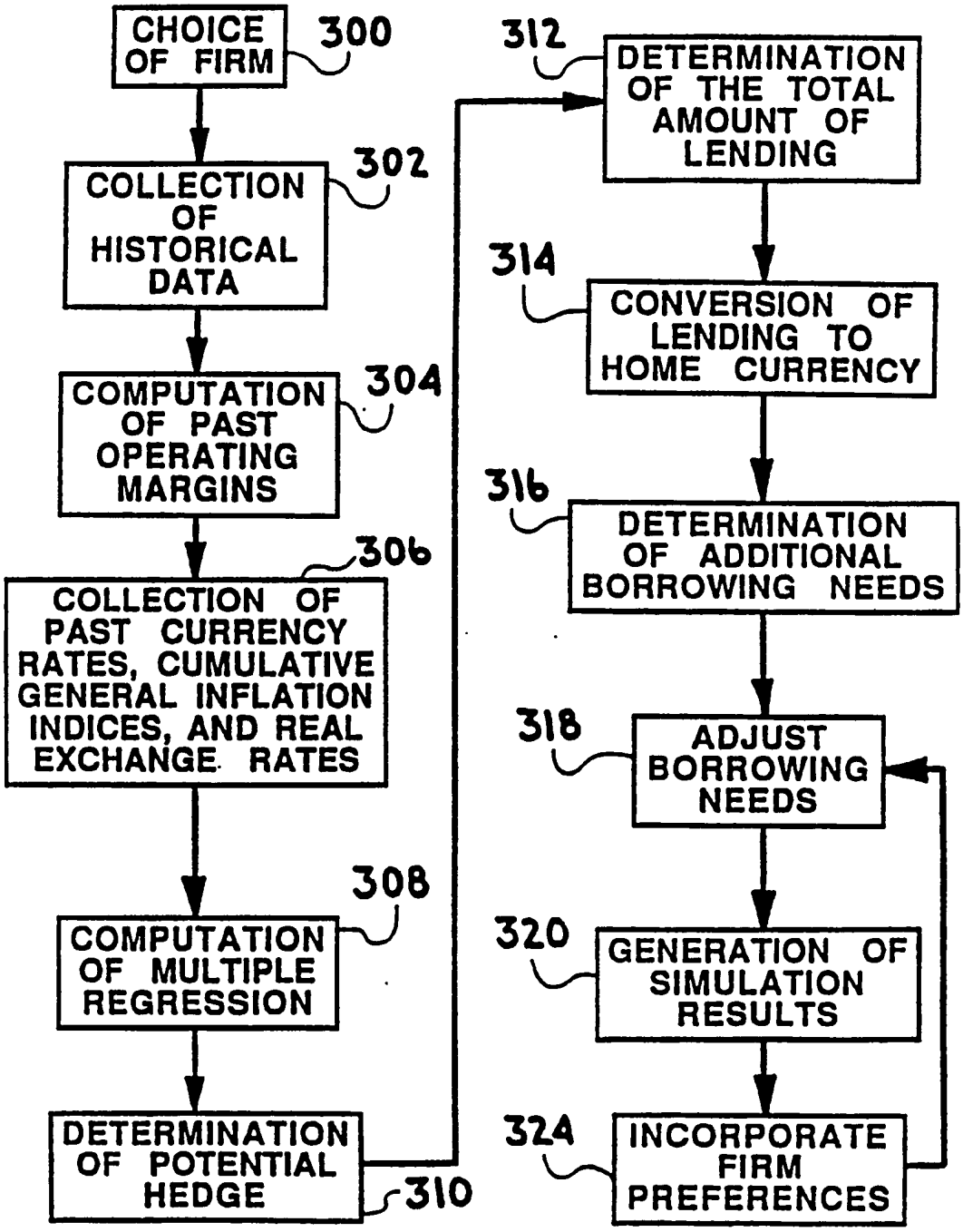
CHOICE OF FIRM
300
COLLECTION OF HISTORICAL DATA
302
COMPUTATION OF PAST OPERATING MARGINS
304
COLLECTION OF PAST CURRENCY RATES, CUMULATIVE GENERAL INFLATION INDICES, AND REAL EXCHANGE RATES
306
COMPUTATION OF MULTIPLE REGRESSION
308
DETERMINATION OF POTENTIAL HEDGE
310
312
DETERMINATION OF THE TOTAL AMOUNT OF LENDING
314
CONVERSION OF LENDING TO HOME CURRENCY
316
DETERMINATION OF ADDITIONAL BORROWING NEEDS
318
ADJUST BORROWING NEEDS
320
GENERATION OF SIMULATION RESULTS
324
INCORPORATE FIRM PREFERENCES

FIGURE 17

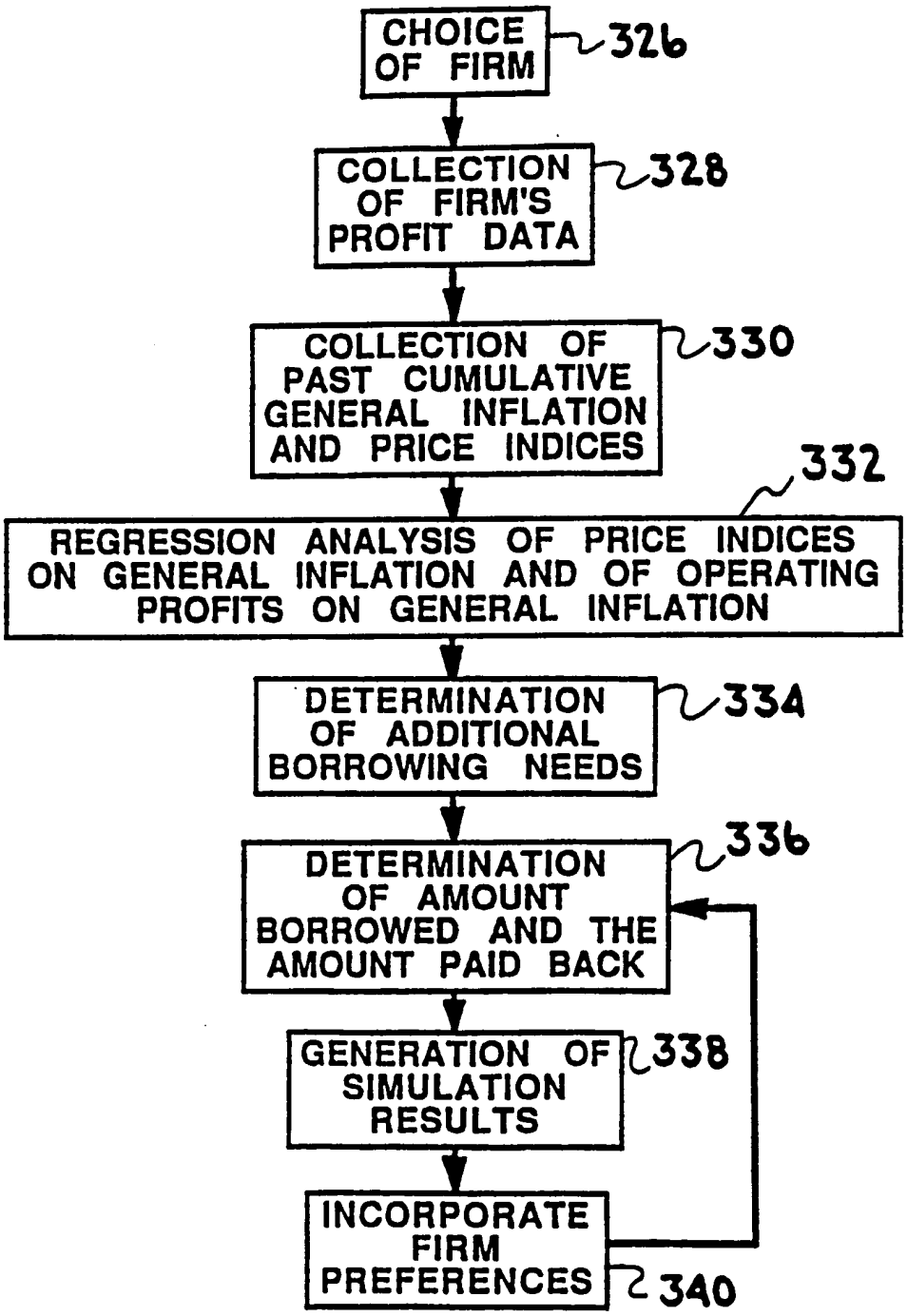
CHOICE OF FIRM
326
COLLECTION OF FIRM'S PROFIT DATA
328
COLLECTION OF PAST CUMULATIVE GENERAL INFLATION AND PRICE INDICES
330
332
REGRESSION ANALYSIS OF PRICE INDICES ON GENERAL INFLATION AND OF OPERATING PROFITS ON GENERAL INFLATION
DETERMINATION OF ADDITIONAL BORROWING NEEDS
334
DETERMINATION OF AMOUNT BORROWED AND THE AMOUNT PAID BACK
336
GENERATION OF SIMULATION RESULTS
338
INCORPORATE FIRM PREFERENCES
340

FIGURE 18

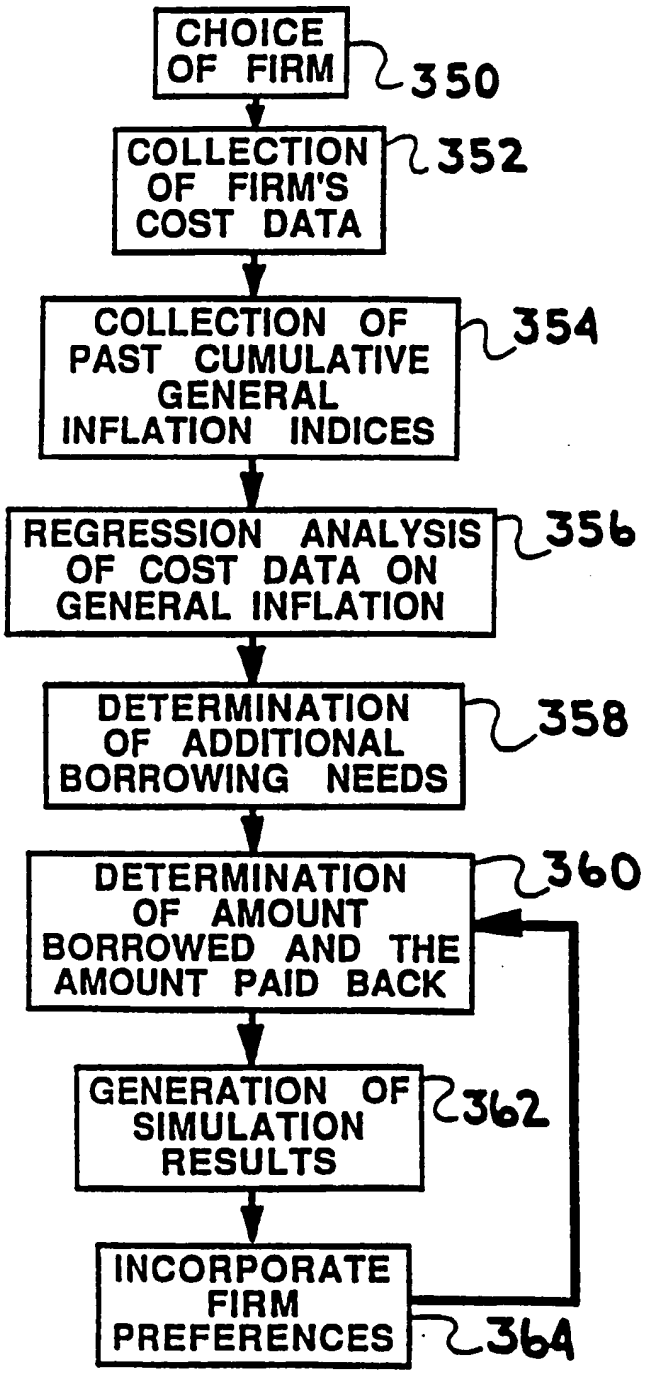
CHOICE OF FIRM
350
COLLECTION OF FIRM'S COST DATA
352
COLLECTION OF PAST CUMULATIVE GENERAL INFLATION INDICES
354
REGRESSION ANALYSIS OF COST DATA ON GENERAL INFLATION
356
DETERMINATION OF ADDITIONAL BORROWING NEEDS
358
DETERMINATION OF AMOUNT BORROWED AND THE AMOUNT PAID BACK
360
GENERATION OF SIMULATION RESULTS
362
INCORPORATE FIRM PREFERENCES
364

FIGURE 19

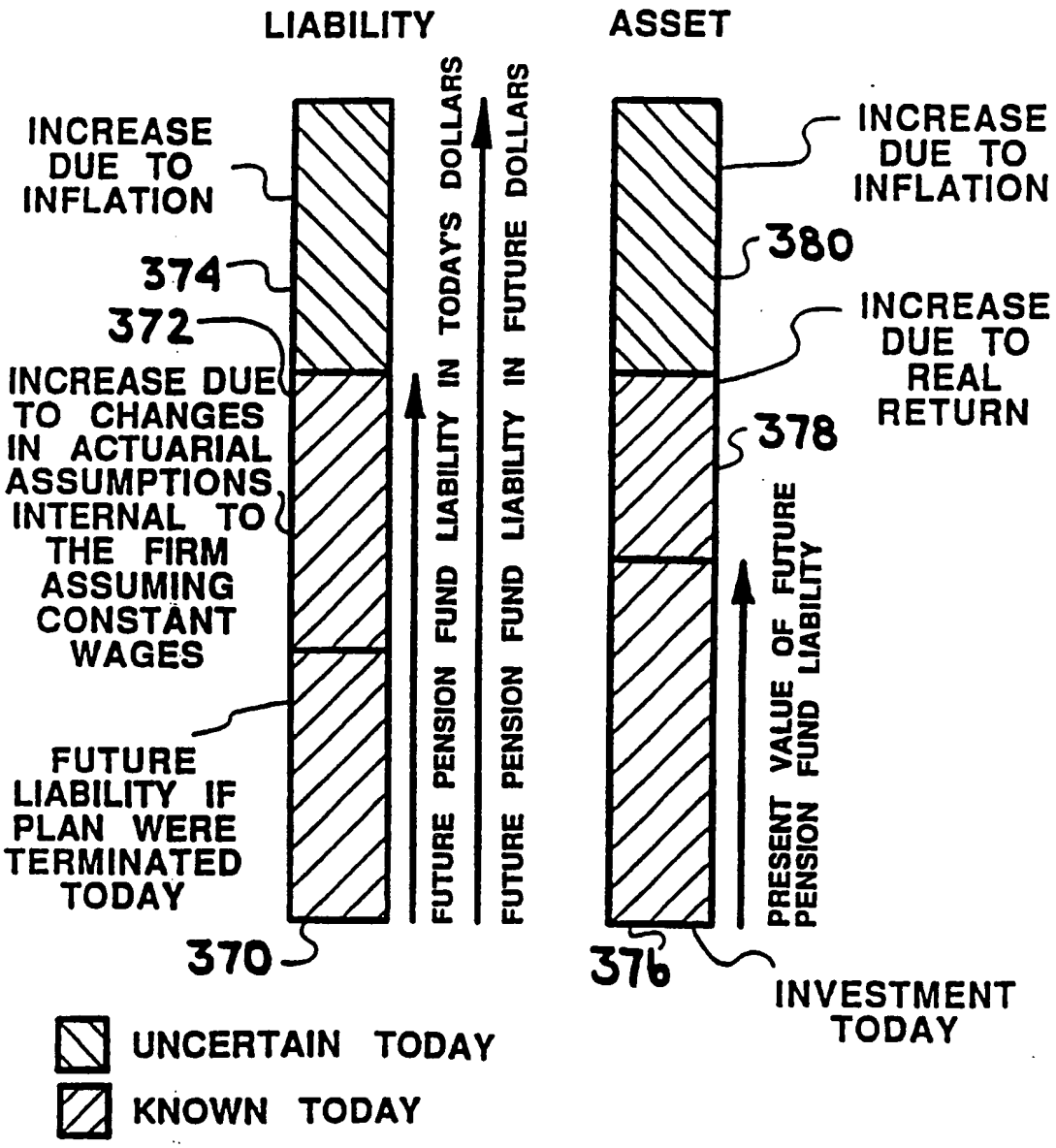
LIABILITY
ASSET
INCREASE DUE TO INFLATION
374
372
INCREASE DUE TO CHANGES IN ACTUARIAL ASSUMPTIONS INTERNAL TO THE FIRM ASSUMING CONSTANT WAGES
FUTURE LIABILITY IF PLAN WERE TERMINATED TODAY
370
FUTURE PENSION FUND LIABILITY IN TODAY'S DOLLARS
FUTURE PENSION FUND LIABILITY IN FUTURE DOLLARS
INCREASE DUE TO INFLATION
380
INCREASE DUE TO REAL RETURN
378
PRESENT VALUE OF FUTURE PENSION FUND LIABILITY
376
INVESTMENT TODAY
UNCERTAIN TODAY
KNOWN TODAY

FIGURE 20

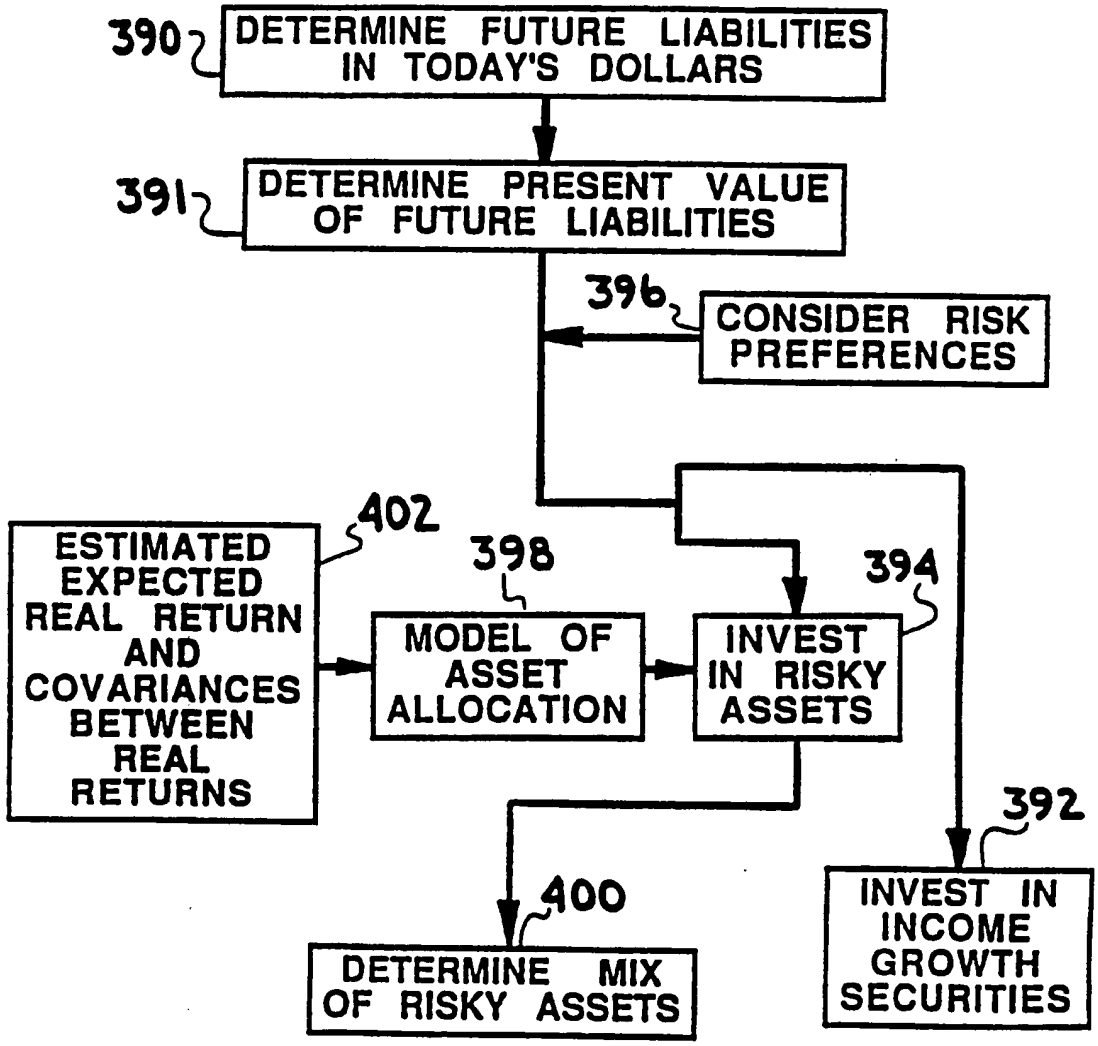
390
DETERMINE FUTURE LIABILITIES IN TODAY'S DOLLARS
391
DETERMINE PRESENT VALUE OF FUTURE LIABILITIES
396
CONSIDER RISK PREFERENCES
402
ESTIMATED EXPECTED REAL RETURN AND COVARIANCES BETWEEN REAL RETURNS
398
MODEL OF ASSET ALLOCATION
394
INVEST IN RISKY ASSETS
392
INVEST IN INCOME GROWTH SECURITIES
400
DETERMINE MIX OF RISKY ASSETS

FIGURE 21

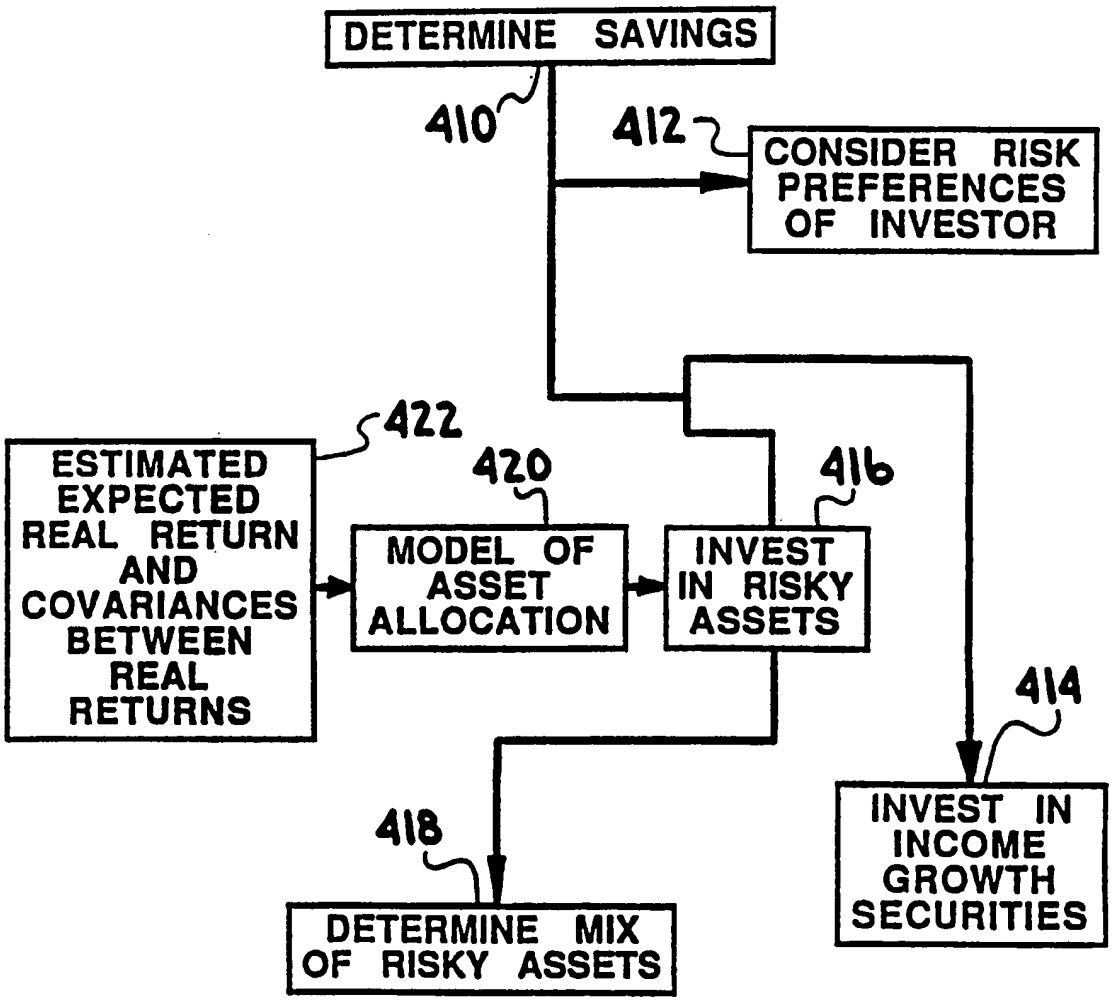
DETERMINE SAVINGS
410
412
CONSIDER RISK PREFERENCES OF INVESTOR
422
ESTIMATED EXPECTED REAL RETURN AND COVARIANCES BETWEEN REAL RETURNS
420
MODEL OF ASSET ALLOCATION
416
INVEST IN RISKY ASSETS
414
INVEST IN INCOME GROWTH SECURITIES
418
DETERMINE MIX OF RISKY ASSETS

FIGURE 22

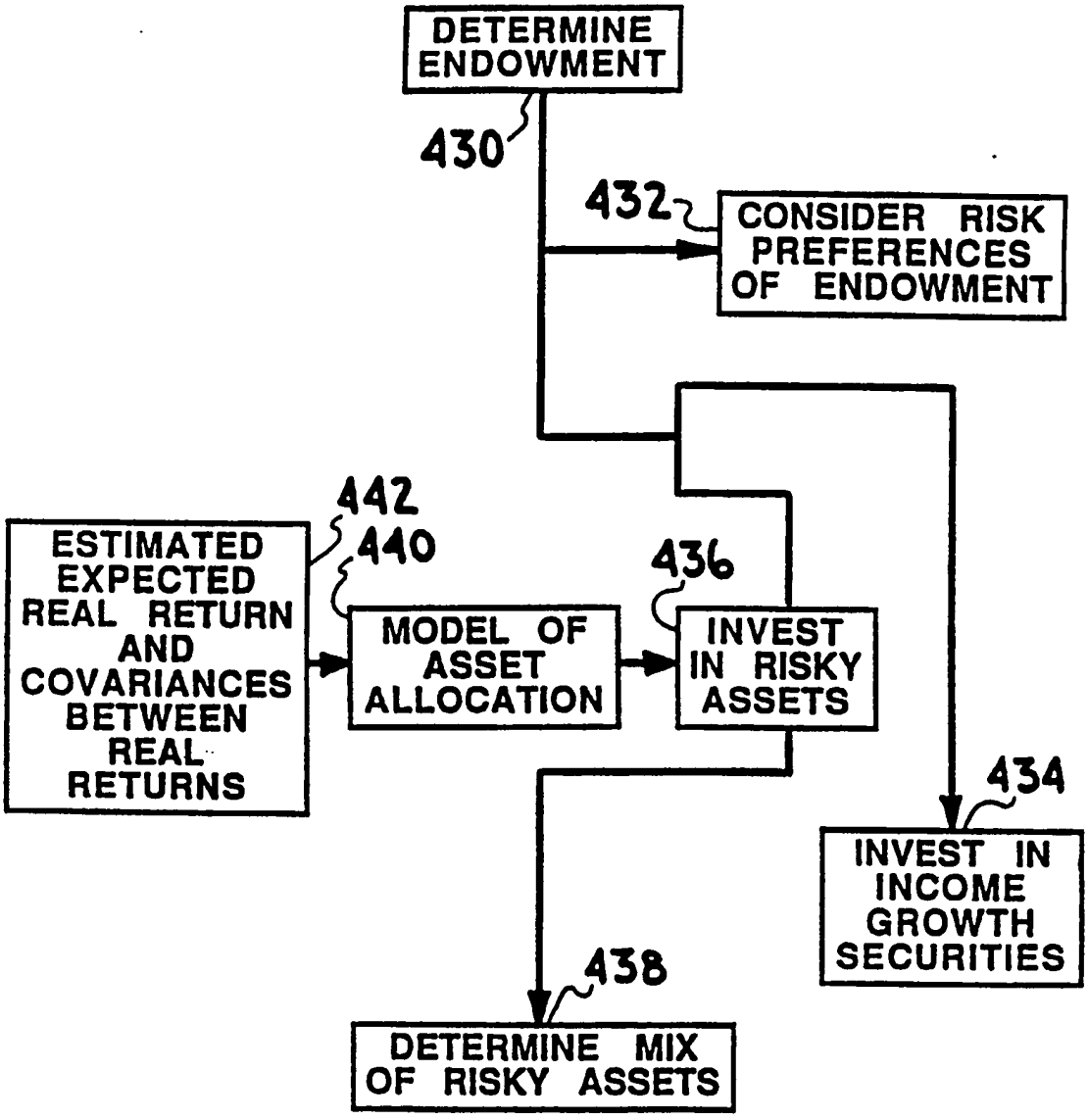
DETERMINE ENDOWMENT
430
432
CONSIDER RISK PREFERENCES OF ENDOWMENT
442
440
ESTIMATED EXPECTED REAL RETURN AND COVARIANCES BETWEEN REAL RETURNS
MODEL OF ASSET ALLOCATION
436
INVEST IN RISKY ASSETS
434
INVEST IN INCOME GROWTH SECURITIES
438
DETERMINE MIX OF RISKY ASSETS

FIGURE 23

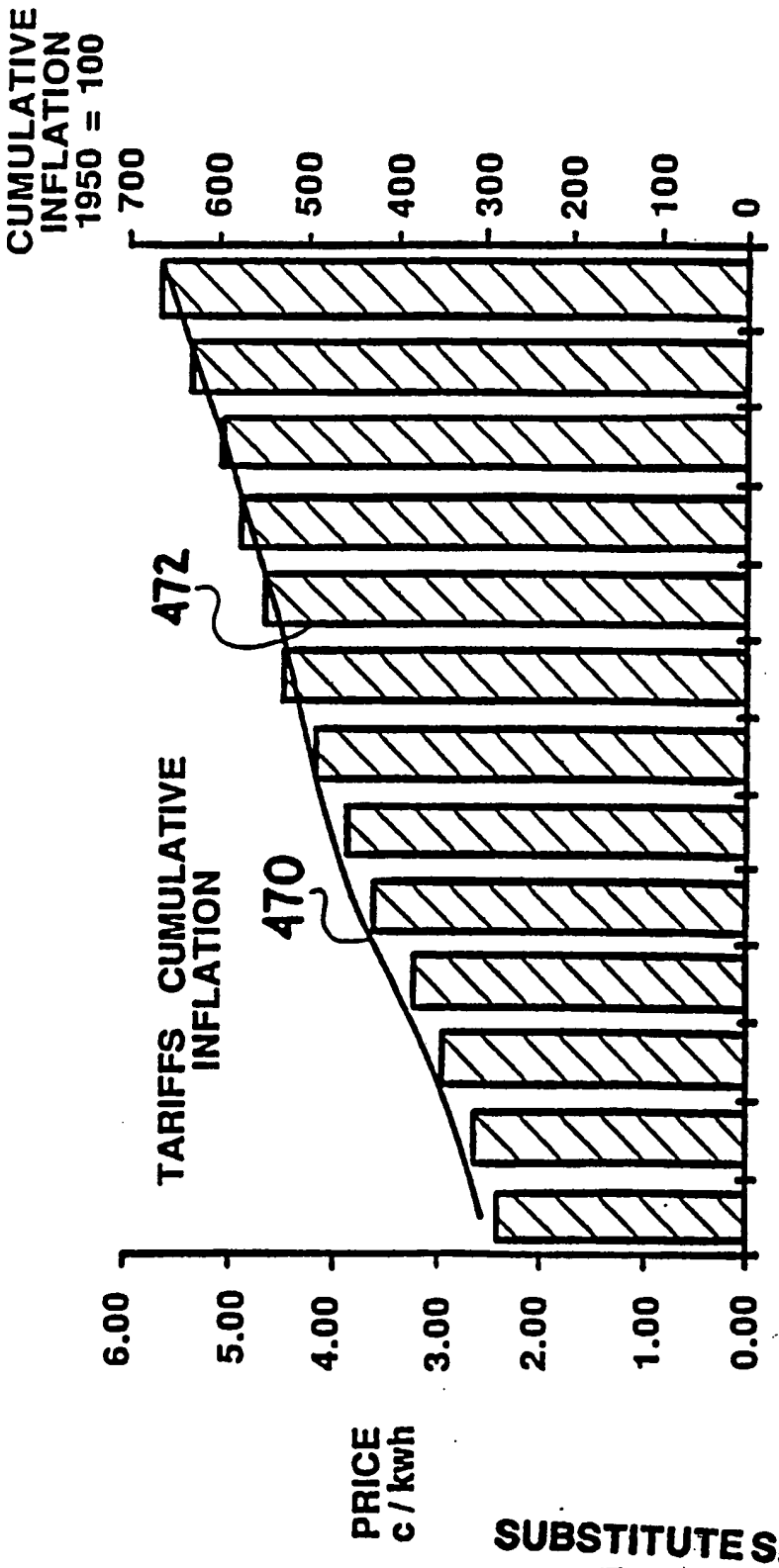
CUMULATIVE INFLATION 1950 = 100
700
600
500
400
300
200
100
0
472
470
TARIFFS CUMULATIVE INFLATION
78 79 80 81 82 83 84 85 86 87 88 89 90
6.00
5.00
4.00
3.00
2.00
1.00
0.00
PRICE c / kwh

FIGURE 24

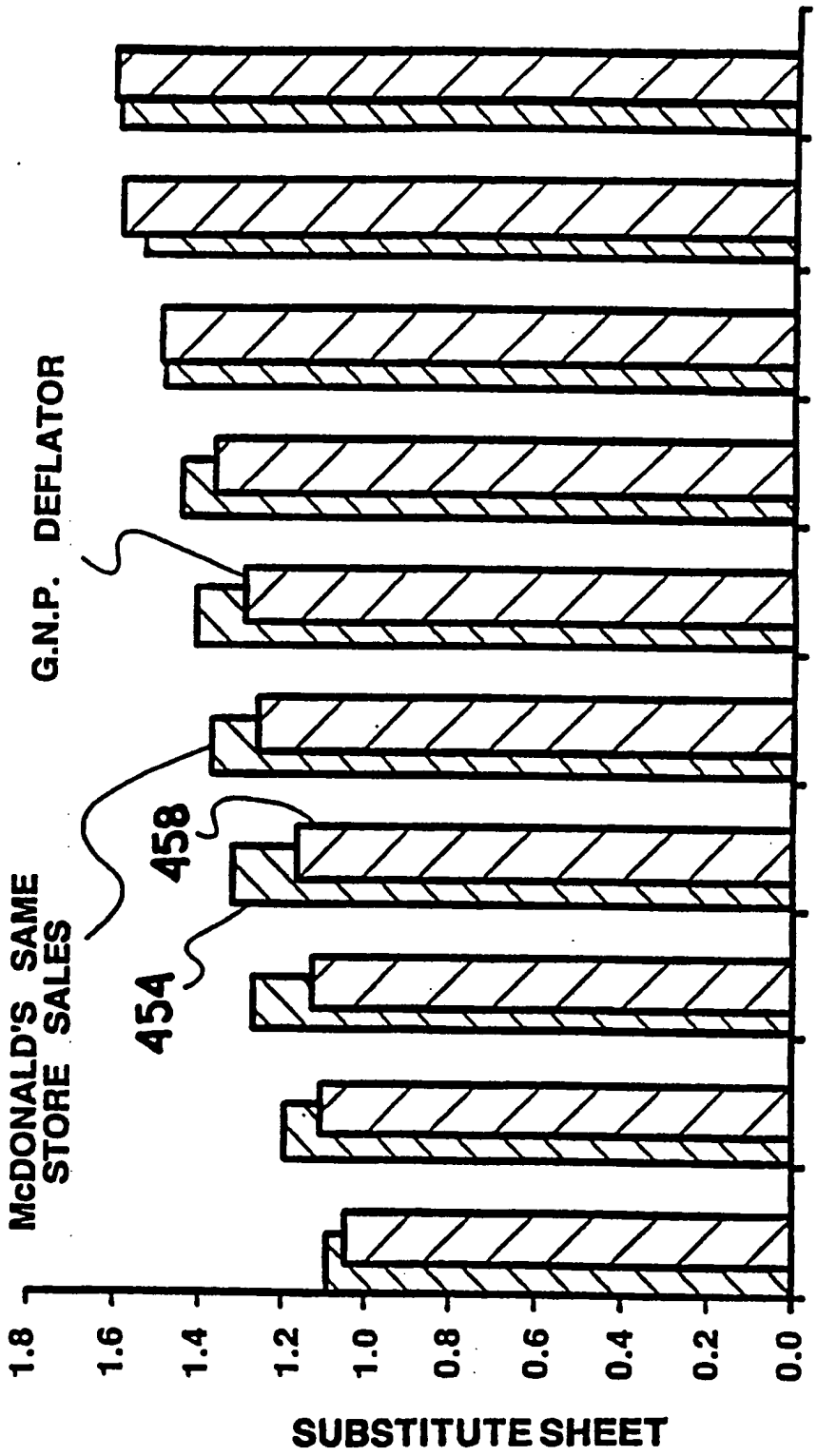
McDONALD'S SAME STORE SALES
G.N.P. DEFLATOR
454
458
80
81
82
83
84
85
86
87
88
89
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
SUBSTITUTE SHEET

FIGURE 25

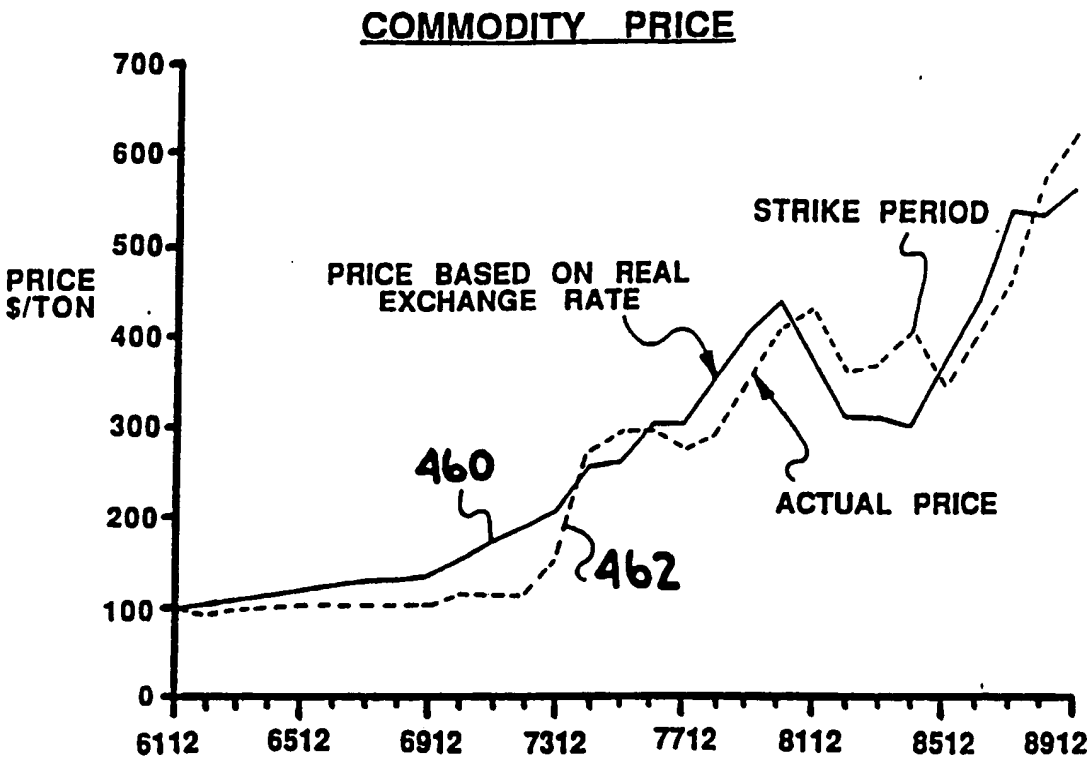

FIGURE 26

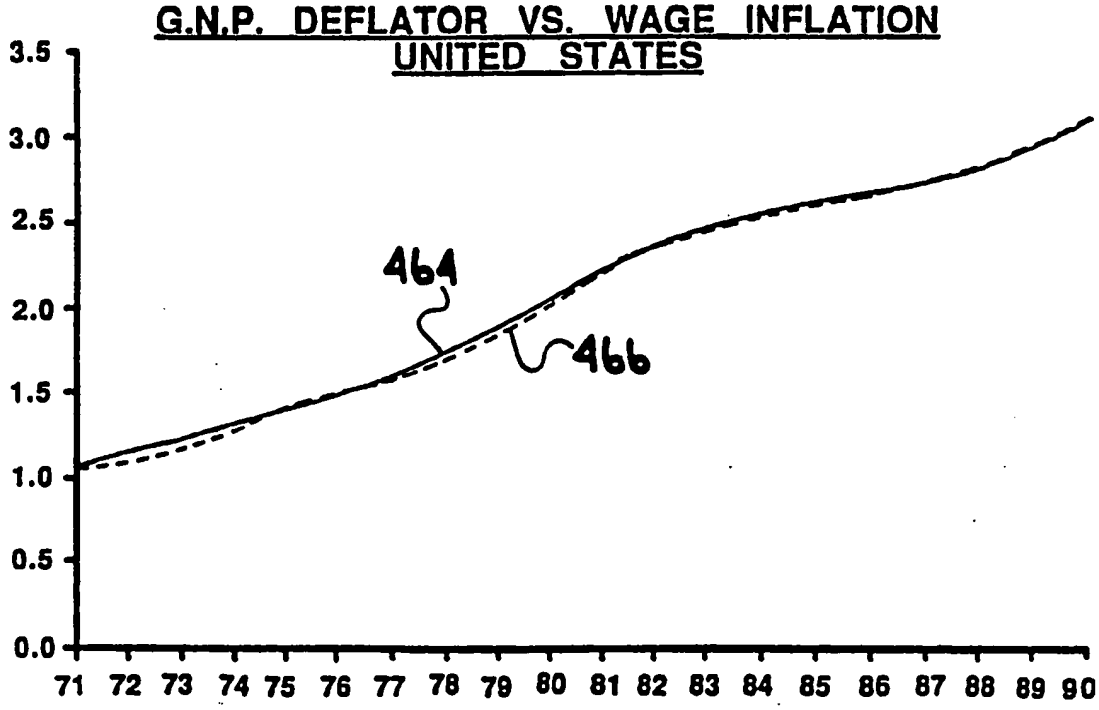

FIGURE 27

INTERNATIONAL SEARCH REP RT

International Application No. PCT/US92/04621

I. CLASSIFICATI N OF SUBJECT MATTER (if several classification symbols apply, indicate all)[3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (5): G06F 15/21
US CL : 364/408

II. FIELDS SEARCHED

Minimum Documentation Searched[4]

Classification System	Classification Symbols
U.S.	364/401

Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched[5]

APS, DIALOG "REGIONAL" FILE

III. DOCUMENTS CONSIDERED TO BE RELEVANT[14]

Category*	Citation of Document,[16] with indication, where appropriate, of the relevant passages[17]	Relevant to Claim No.[18]
Y,P	The Financial Post, 26 October 1991, "Indexed Bonds Get a Mixed Reception", p. 21, see entire document.	139-141
Y,P	Finance East Europe, 20 February 1992, "Government Bonds Approved", see entire document.	139-141
Y	Daily Telegraph, 07 December 1990, "Anglian Dips Into Eurobonds", p. 20, see entire document, (abstract only provided).	139-141
Y	Forbes, vol. 136, 15 July 1985, Forbes, "On the subject of interest rates: Proposed Legislation Would Create Treasury Bonds Indexed for Inflation", p.23, see entire document.	139-141
Y	Business Economics, September 1979, "Problems With Indexed Bonds are Discussed by RH Scott, Univ. of Washington", p.19-22, see entire document, (abstract only provided).	139-141
Y	Pension & Investment Age, 21 January 1985, "Funds Not Clamoring for Indexed Bonds", p. 92, see entire document, (abstract only provided).	139-141

* Special categories of cited documents:[16]

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search[2]	Date of Mailing of this International Search Report[2]
09 JULY 1992	07 AUG 1992
International Searching Authority[1]	**Signature of Authorized Officer[20]**
ISA/US	DAVID M. HUNTLEY (703) 308-0702

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

Y,P	Financial Times (London), 14 October 1991, "Indexed Bonds a Hedge Against Defl tion", p. 18, s e entire document, (abstract nly provided).	139-141
Y	US, A, 4,742,457 (LEON ET AL.) 03 May 1988, see entire document.	139-141
A	US,A, 4,752,877 (ROBERTS ET AL.) 21 June 1988, see entire document.	139-141

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE[1]

1. ☐ Claim numbers _, because they relate to subject matter (1) not required to be searched by this Authority, namely:

2. ☐ Claim numbers _, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out (1), specifically:

3. ☐ Claim numbers _, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING[2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Search Authority did not invite payment of any additional fee.

Remark on protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.